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Index to Advertisers and Classified Index Following Reading Matter.

"THE FLAT TURRET"

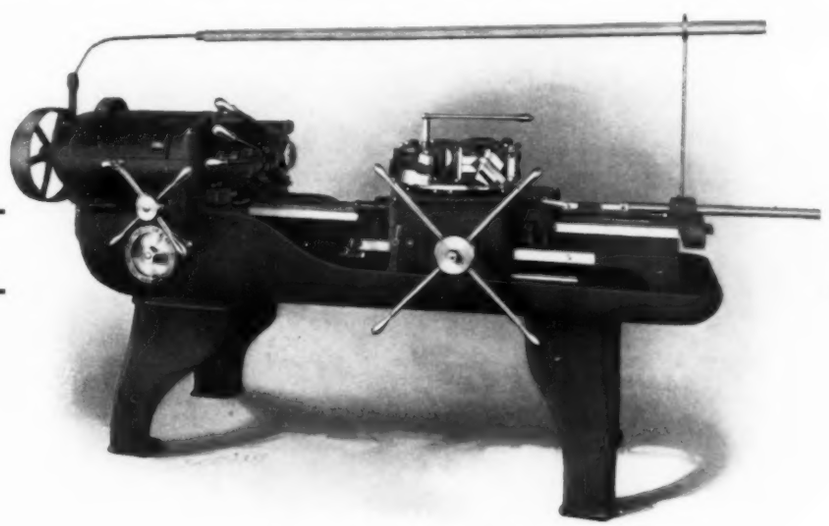
"THE FLAT TURRET"

"THE FLAT TURRET"

The New Dress Of The Ever Popular "Flat Turret" Lathe.

This is the same "Flat Turret" Lathe you have known for the past fourteen years, with one or two little changes made necessary by changed conditions of business. It still retains all of the profit producing features of the old "Flat Turret" and has in addition, features which make to still faster gains in the production of duplicate work. It is now made in sizes 2″ x 24″ and 3″ x 36″. Take the size that will serve you best. One of the new features of the "Flat Turret" as it now stands is the cross-sliding head-stock, a thing long desired.

The cross-feed head grew out of our desire to provide a single-drive self-contained variator; this also led to the placing of all shafting and gearing in a horizontal plane so that the lower half of these running parts could be submerged in oil, insuring perfect lubrication. The new head-stock means that a greater range of work may be handled and with the use of high-speed steels work may be handled faster than on the old style "Flat Turret." We shall be pleased to send you all details of the new, old "Flat Turret," and believe that you can well afford to install one, assuming that your intent in business is profits.

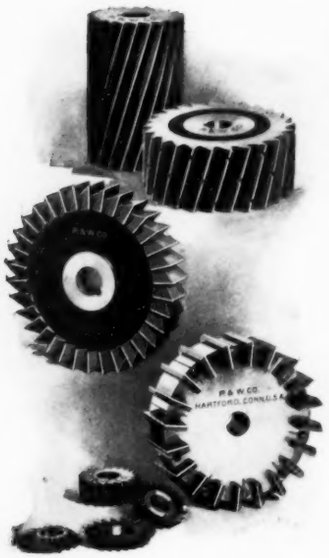


The "Flat Turret" Lathe.

Jones & Lamson Machine Company

Springfield, Vt., U.S.A., and 97 Queen Victoria St., London, E.C.

Germany, Holland, Belgium, Switzerland and Austria-Hungary: M. Koyemann, Charlottenstrasse, 112, Dusseldorf, Germany.
France and Spain: Ph. Bonvillain, 6, Rue Blanche, 6, Paris, France. Italy: Adler & Eisenschitz, Milan.



Small Tool Department.

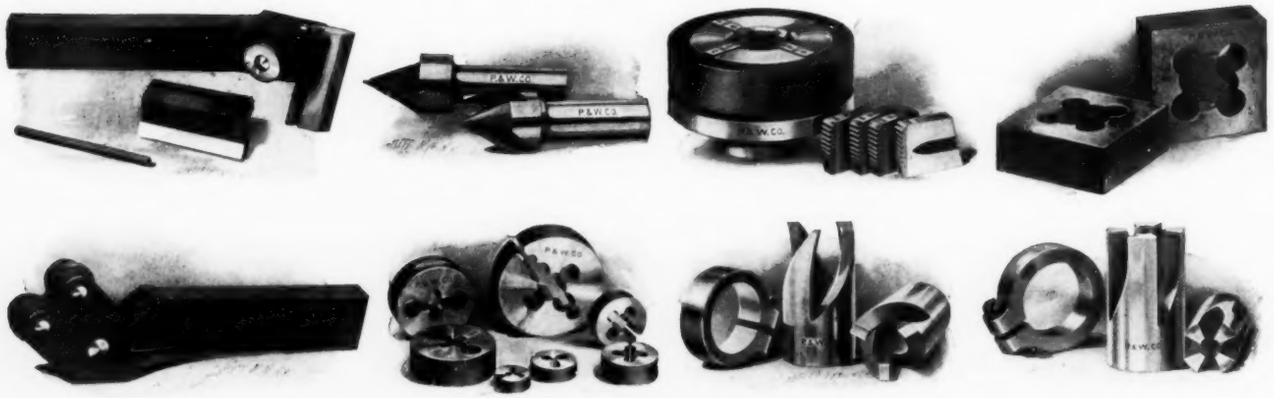
Pratt & Whitney Co.,

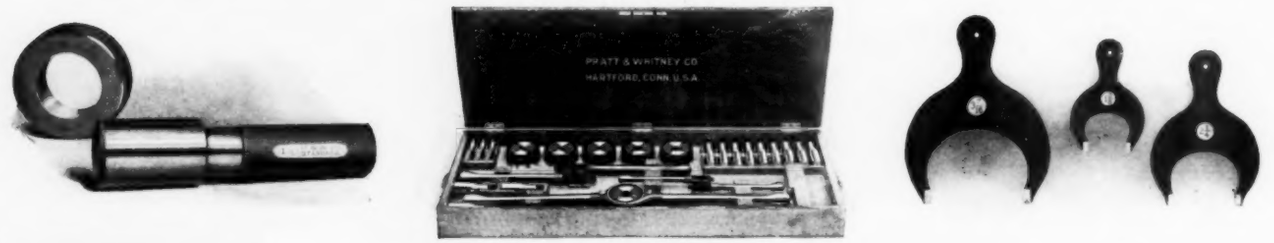
136-138 Liberty Street,

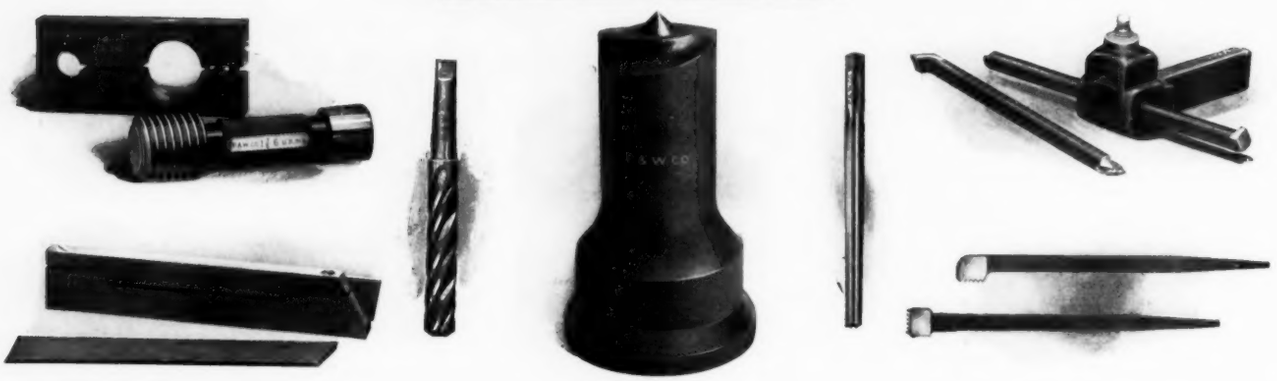
New York.

Works :—Hartford, Conn., U. S. A.

(See Opposite Page.)







The Shops of the Jones & Lamson Machine Company

EDITORIAL CORRESPONDENCE.

Revisiting Springfield, Vermont, recently, after an absence of nearly five years, I had the opportunity of looking over the new shop of the Jones & Lamson Machine Company and of examinining, among other things of interest, the construction of their flat turret lathe as now built with cross feeding head.

This machine has been somewhat briefly described in these columns at page 585; it has, however, so many features of interest to mechanics in general that nothing less than a detailed account of its construction and operation will do it justice. It will therefore be taken up at length in a subsequent article, while this paper will be devoted more especially to a description of the new buildings, together with the present arrangement of the plant as a whole.

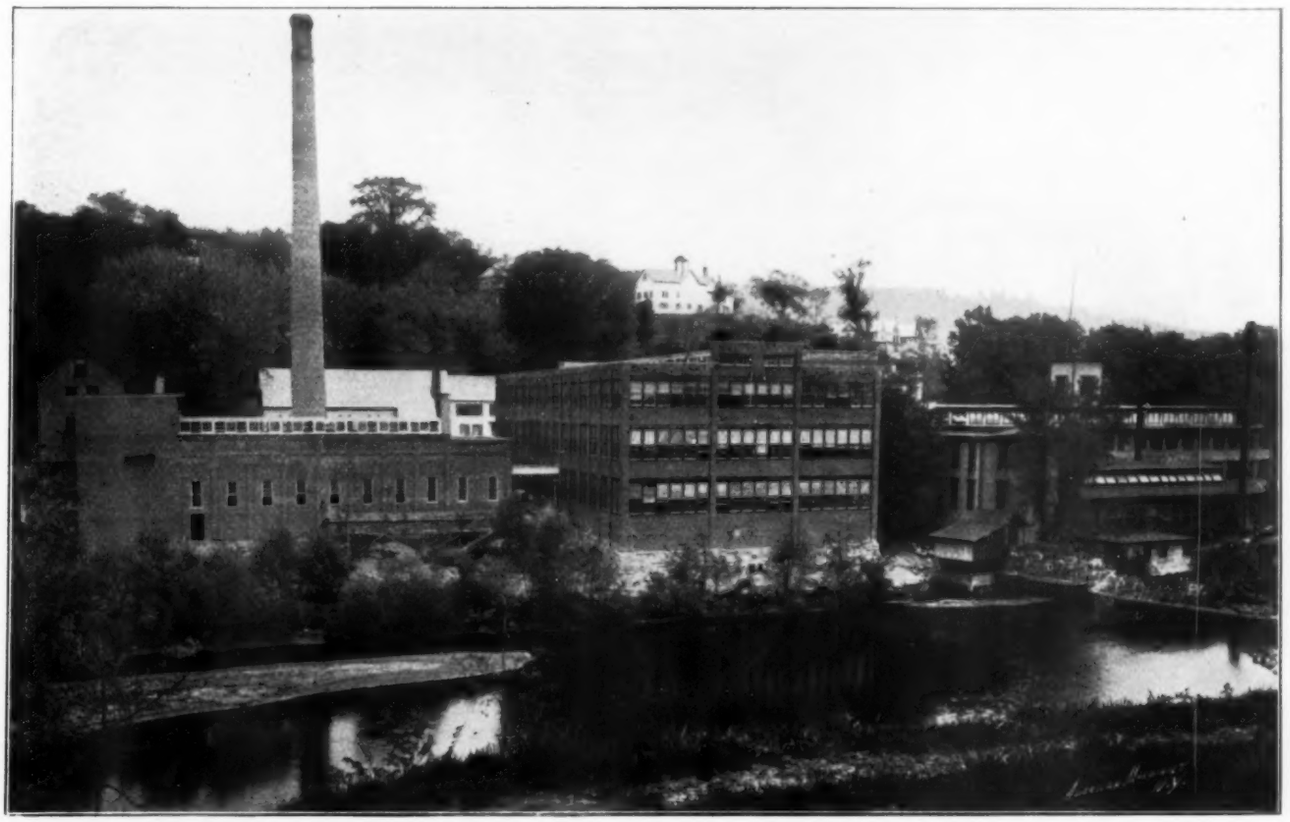


FIG. 1. GENERAL VIEW OF JONES & LAMSON SHOPS—FROM THE REAR.

As all readers of the AMERICAN MACHINIST are aware, this concern has built turret lathes for nearly fifty years, or since 1855. The first building of the present plant, however, was erected in 1888, the business of the company prior to that time having been carried on at Windsor. In 1893 a second machine shop, two stories high, was constructed, and in 1900 a new all-steel, fireproof blacksmith shop was erected at the rear of what was until recently known as the new shop. The latest addition to the manufacturing plant, a three-story fireproof building, with 75-foot front and 150 feet in depth, was completed in 1902, increasing the floor area available for manufacturing purposes to about 64,000 square feet; at the same time was put up a new power-house to supply electric current for lighting and operating purposes.

Those acquainted with the topography of Springfield will appreciate the difficulties attending any efforts to secure from the front, or Main street, side of the shops any satisfactory photograph of the plant as a whole. The view in the half-tone, Fig. 1, therefore is from the west side of the Black river, and gives an excellent idea of the appearance presented by the shops from the rear.

The new machine shop, which, as will be seen by examining the general view extends from the street almost to the river bank, is of brick, steel and concrete construction, the only woodwork being in the window frames and sash. The brick walls are lined with cement, and the roof is of the same material. The floors are of reinforced concrete construction, and the columns are filled in and faced with concrete, so that at no point whatever is the steel in the upright members exposed.

A cross-section near the lower, or western, end of the building is given in Fig. 2; this shows something of the building foundation, the floor supports and construction, the proportions of the roof monitor, etc. The land near this lower end of the shop slopes sharply toward the south and west, and, because of the character of the soil at this point, the central portion of the structure for a distance of some 40 feet from the rear is carried on pairs of 24-inch I-beams, which rest on stone piers. A section of the side and end walls under the building will be noticed at the lower right-hand corner of the view given in this drawing.

The 20-inch I-beams running transversely of the structure have a 25-foot span and are spaced 10 feet apart, the floors being designed to carry safely loads of 250 pounds per square foot. A detail of the floor construction is shown in Fig. 3, and an examination of this sketch will show that the floors are reinforced with expanded-metal and 5-inch I-beams, the latter being spaced 3 feet apart. The concrete mixture covers the upper faces of the I-beams to a depth of 1 inch and is arched from the bottom to a thickness of 2 inches at the center. On top of this is a 1-inch cement surface leaving the floor at the lightest point 3 inches deep. The fireproof roof is also reinforced with expanded metal, and both monitor and main roofs are covered with a layer of gravel.

This fireproof building is shut off from the passageway leading from the old shops by automatically closing fire doors on each floor, and as each floor is well supplied with fire hose it would seem as if ample provision had been made for controlling any conflagration in the other buildings. Also, as the steel columns in this latter building are so thoroughly protected with concrete, there is no possibility of these supporting members being weakened in

any way through burning waste, oil or other inflammable material likely to be used around a machine shop.

The new shop, like the rest of the plant, is heated and ventilated by the Sturtevant system of blowers, and the building is well lighted by its monitor and numerous other windows—which at one side and end of the lower two floors have the Luxfor prismatic glass in the upper sash—and artificially by some sixty enclosed arc lamps of 1,000 candle-power each and by numerous incandescent lamps for different machines.

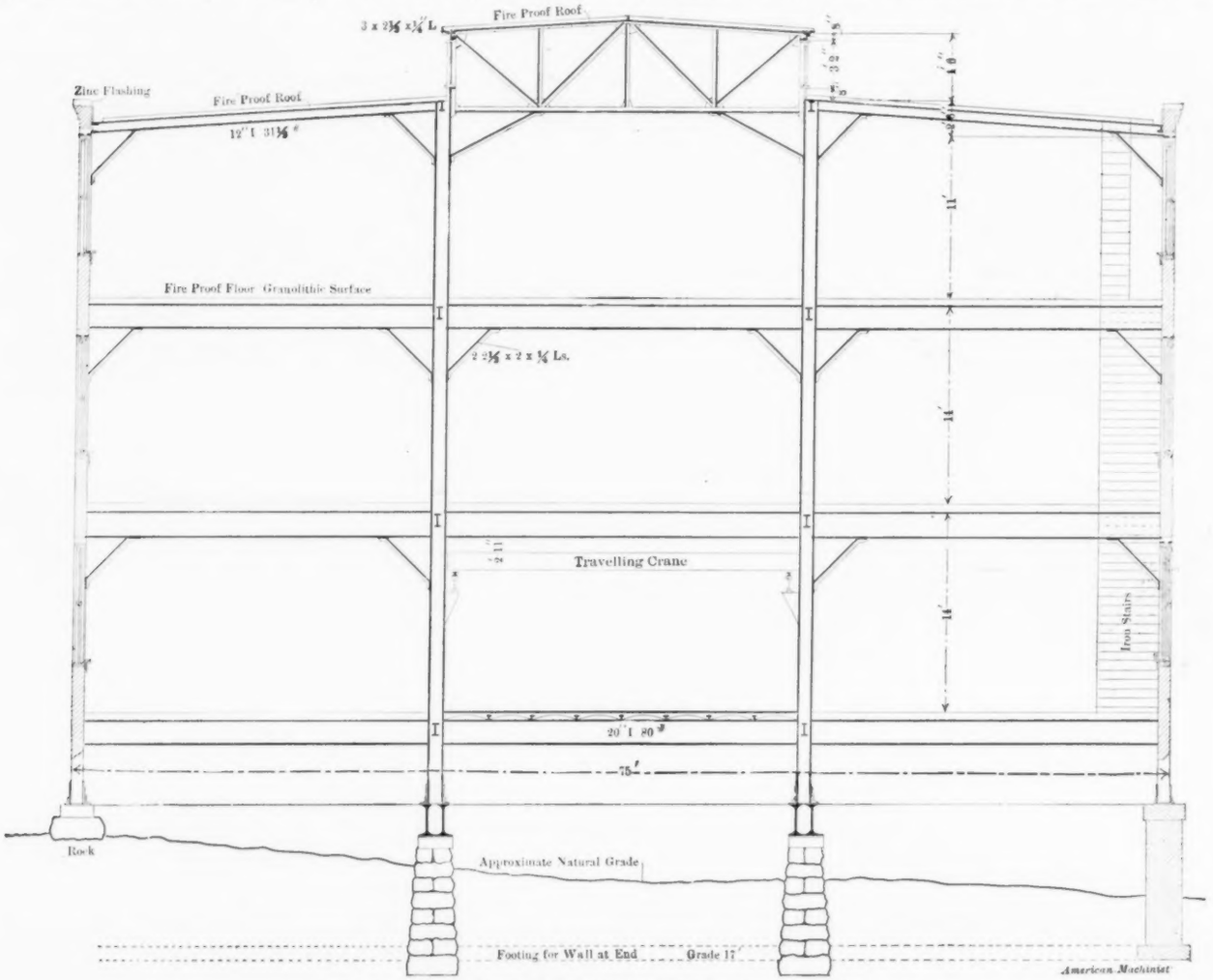


FIG. 2. CROSS-SECTION THROUGH LOWER END OF NEW SHOP.

The workmen's entrance to the shops is by way of what was originally the planer department, this room now being utilized wholly as a locker room in which the employees keep their clothing, etc. There are upward of 260 individual lockers here, and immediately to the rear is the washroom. Overhead are the general offices and the superintendent's office reached by a stairway from the street; and to the left of these is the drafting room, Fig. 4, now occupying a portion of the floor formerly taken up by the screw machine department.

From the locker room the men pass either to the left to the old shops or to the right to reach the new building. However, before entering into the details of the arrangement of the departments and the machinery in this building, we will pass directly through to the new power-house lying to the north of the machine shop and separated from it by a narrow alley.

The power-house with the coal-storage building included is 120 feet long. It is of steel and brick with cement floors, and the engine and generator room which is 50 feet long by 42 wide, is arranged as represented in Fig. 5. The equipment in this room includes a Brown 150 horse-power automatic cut-off, cross-compound, condensing engine, fitted with safety stop and belted to a 100-kilowatt generator; a 100 horse-power McEwen high-speed engine belted to a 75-kilowatt generator; an Ingersoll-Sergeant 35 horse-power steam driven duplex air compressor. Steam is generated by two Stirling water-tube boilers rated at 150 and 200 horse-power, respectively, and the furnaces, whose products of combustion are taken care of by a chimney 150 feet in hight, are equipped with the Roney mechanical stokers; the coal shed, into which fuel cars are run over a spur of the Springfield Electric Company's line, being built on a considerably higher level than the floor of the boiler-house. The boilers are fed ordinarily by a motor-driven pump, but in addition to this an inspirator, a steam pump and a tank for feeding are provided. The boiler-house contains also a Dean duplex steam fire pump having a capacity of 1,500

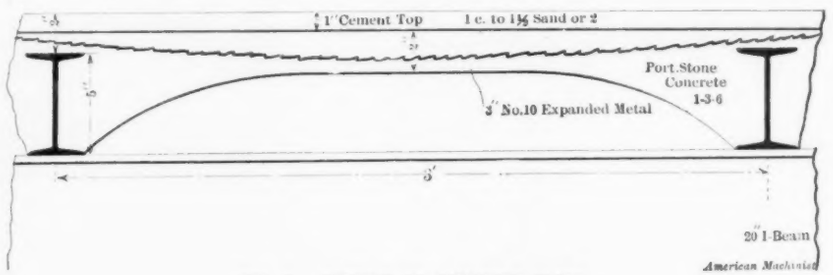


FIG. 3. SECTION OF CONCRETE FLOOR.

FIG. 4. VIEW IN DRAWING ROOM.

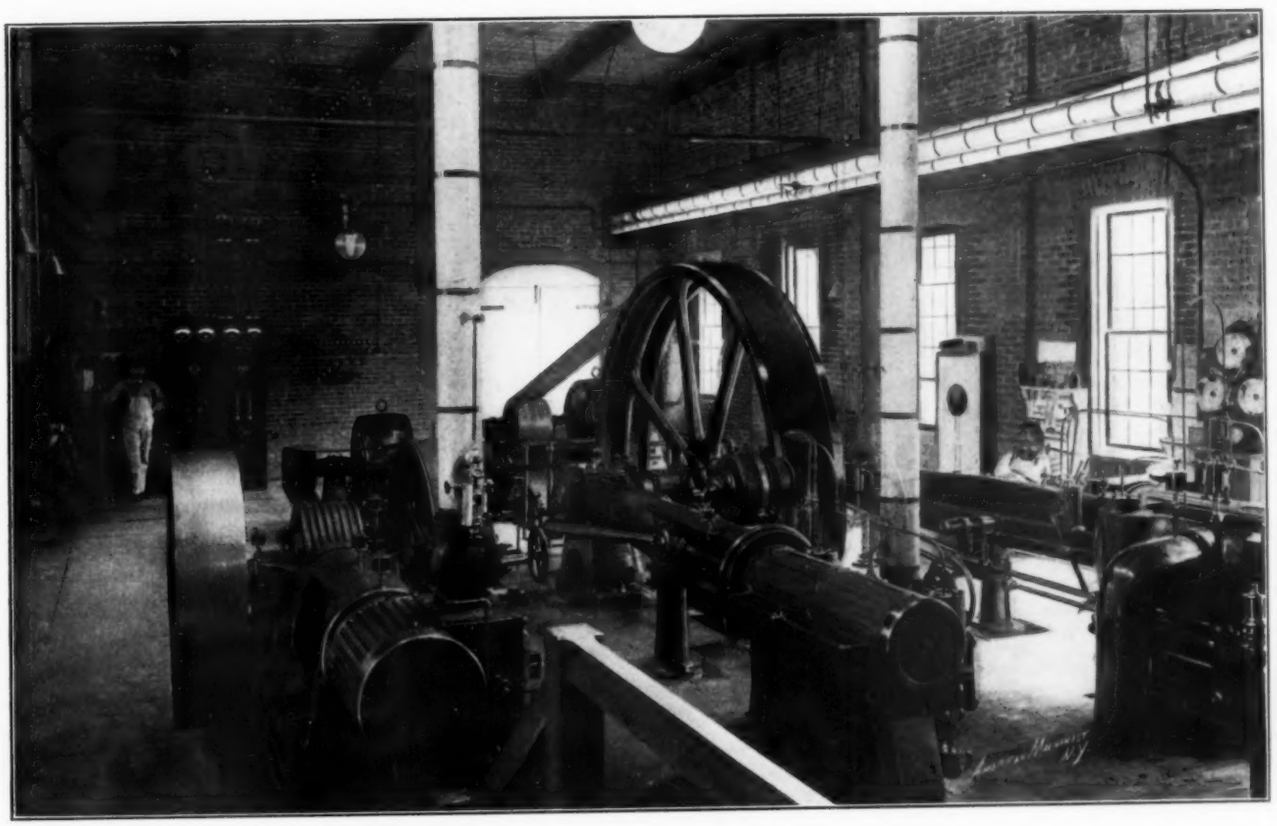


FIG. 5. VIEW IN POWER PLANT.

gallons per minute, and since the installation of this pump the town has put in a system of water works with fire hydrants, so that the shop is pretty well equipped for fighting fire.

Both of the generators mentioned above are Bullock machines for supplying direct current at 240 volts, the larger generator being used ordinarily for power purposes and the smaller for lighting only. The Bullock multiple-voltage system (4-wire) is used throughout the new shop—the balancer being located on the second floor—and the entire plant is electrically driven (as well as lighted) with the exception of a very few machines in one of the older departments. With this system are obtained six distinct voltages and, through controllers, as many base speeds for the variable-speed motors of which there are a considerable number about the place.

Some highly interesting examples of individual drives and also of group driven tools may be seen in different departments, and several such are on the lower floor of the new shop, a portion of which floor is illustrated in Fig. 6. As will be noticed, the central aisle is devoted to the erection of the flat turret lathe with cross-feeding head; it is served by a Maris 5-ton electric crane with 24-foot span and whose runway extends the entire length of the building. At the extreme upper end of the floor is a Beaman & Smith motor-driven horizontal boring, drilling and tapping machine which is used for drilling and boring holes in the sides and ends of the machine beds, and at the right-hand side of the erecting aisle are a number of other individually driven tools—among them a Bullard 42-inch vertical boring mill, a Baush 6-foot radial drill, a Fellows 36-inch gear shaper, a Becker-Brainard vertical miller, a Baker Bros. 4-spindle drill. There are several Franklin cranes on this floor, and for handling heavy work in the vertical mill and radial drill a jib crane with air hoist is provided, the crane being so located as to swing over the tables of both machines.

To the left of the erecting floor is a long line of planers, several of which may be seen in the half-tone. These are driven by a shaft belted from a 38 horse-power motor located near the Sturtevant blower shown at the center of the planer department. Beyond this line of planers is a group of four Whitcomb 24-inch "second belt drive" machines (Fig. 10), driven directly from a single shaft which is belted from a 10 horse-power motor located above the crane runway. The shaft runs in bearings attached to the rear of the housings, and each of the four pairs of driving pulleys is connected to the shaft by a friction clutch which may be released at any time to throw the planer below out of action. Directly across the shop from this battery of planers is a group of Brown & Sharpe and Landis grinders, also driven from one motor.

FIG. 6. MAIN ERECTING FLOOR.

To the erecting floor in Fig. 6 come the beds as machined on the large planer in the old shop, and here a number of holes and bearings are bored out, the shears and saddles are scraped, the heads already assembled in what was formerly the screw-machine department, properly fitted, and the machine finished except for the boring out of the tool holders, which operation is performed just before the machine reaches the paint shop. The engine lathe work, the milling and the greater part of the gear cutting are still done on the main floor of the old shop. Of course a great deal of the work in connection with the building of these turret lathes is turned out on the flat turret and other screw machines. The screw machine department occupies the greater portion of the second floor of the new building and comprises a most interesting equipment, as will be seen by examining Figs. 7 and 8, which show two views from opposite points on this floor.

Two lines of shafting, each driven by an 18 horse-power motor, extend the full length of this department. One of these drives a number of flat turret lathes and a line of automatics of various types. The majority of the turret machines, however, especially those of the heavier patterns, are driven by individual motors. A number of machines so driven will be noticed in Fig. 8, and five of those most prominently brought out in this view are flat turret lathes with hydraulic feed for the carriage. As might be expected, these are of most ingenious and interesting construction, and in a later article they will be taken up somewhat in detail.

The other line of shafting noted drives

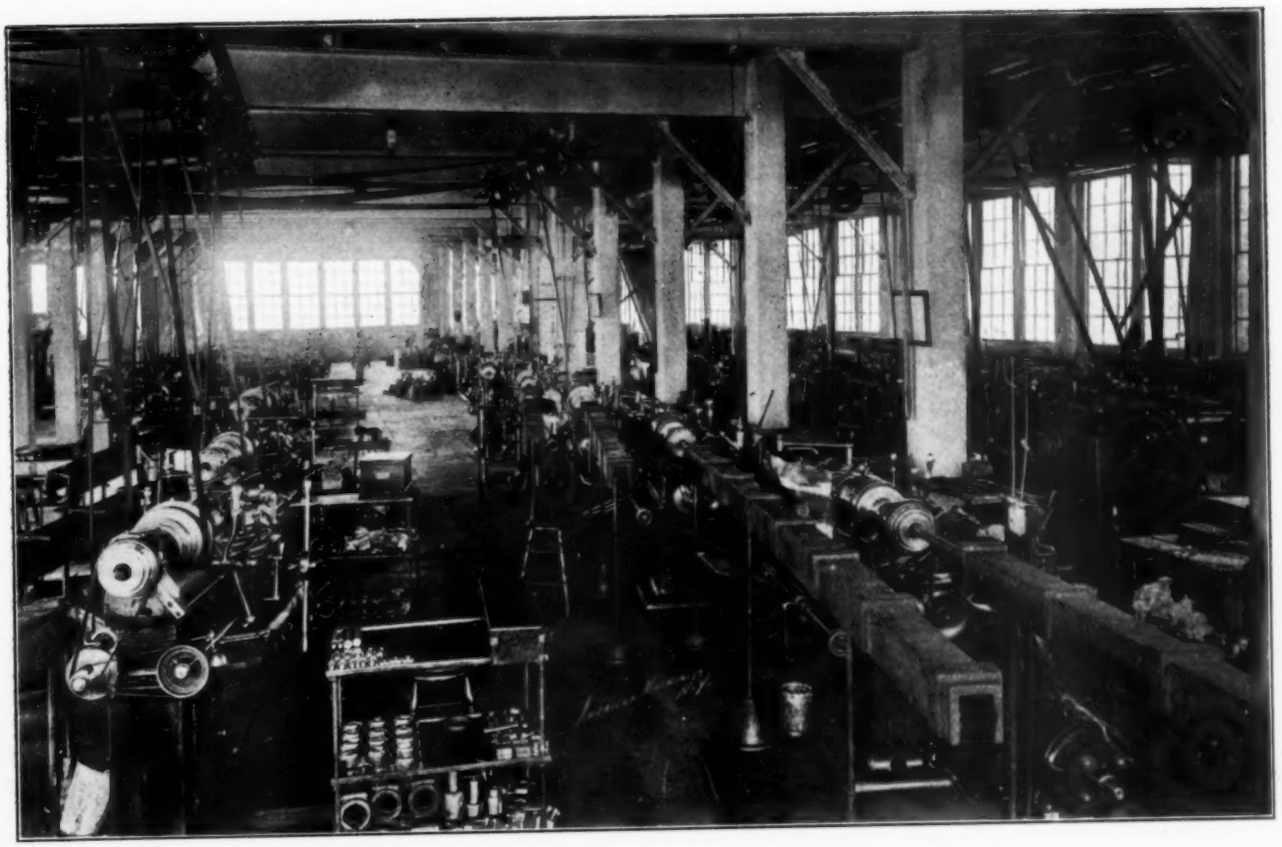


FIG. 7. SCREW MACHINE DEPARTMENT.

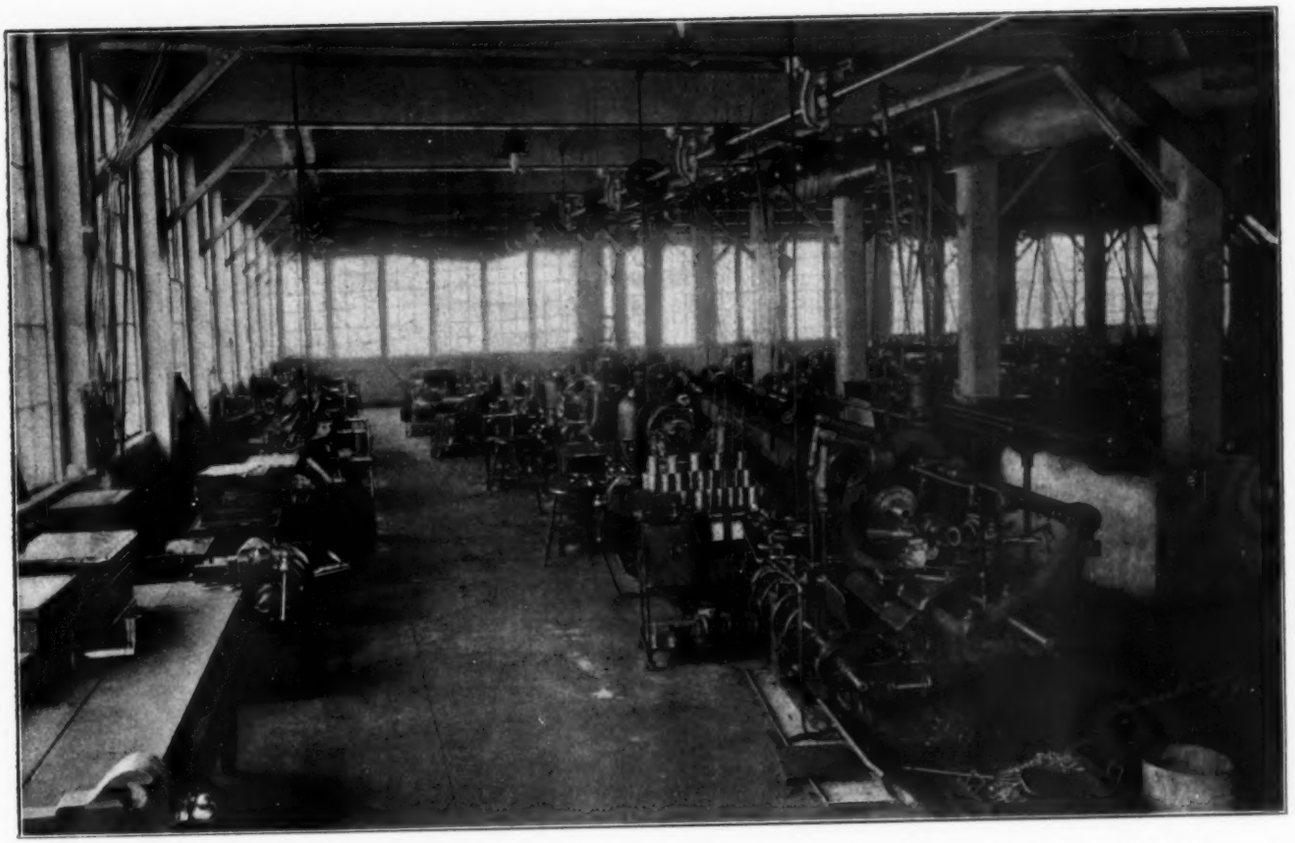


FIG. 8. VIEW IN SCREW MACHINE DEPARTMENT, SHOWING A LINE OF FLAT TURRET LATHES WITH HYDRAULIC FEED.

a few light machines in this department and also operates a number of machines in the tool section (Fig. 11) at the lower end of the floor. Most of the tool lathes, however, have individual drives, five of a line of eight being Hendey 16-inch and one a Springfield 18-inch, with motors on the heads. These lathes stand at an angle, having, as shown, a length of 25 feet and a width of 21 inches. The projecting bottom of the car extends nearly to the relieved edge of the floor, two stops preventing the material from rolling over the edge. The elongated opening in each floor is of course guarded by a hand-rail; and the rods carrying the gates are suspended

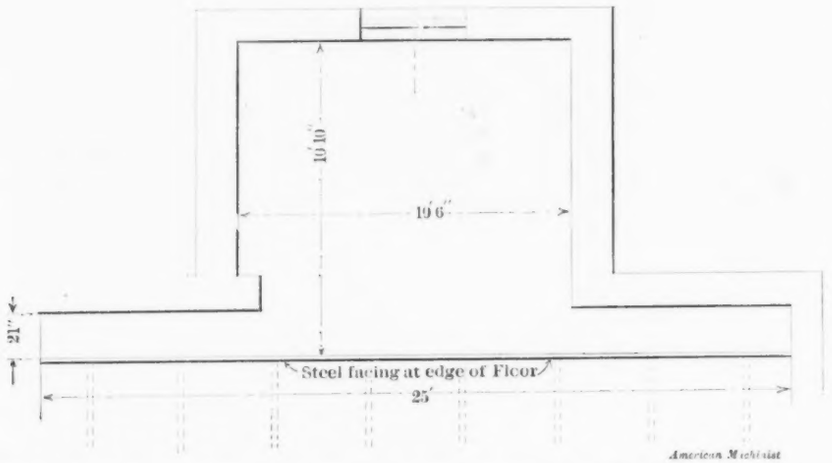


FIG. 9. PLAN OF ELEVATOR SHAFT, SHOWING LONG RECTANGULAR OPENING IN EACH FLOOR.

and are so placed as to be exceedingly well lighted. At this end of the second floor are also a number of benches on which are put together the tools in the regular flat turret equipment; while on other benches are assembled the carriage aprons and their feeding mechanisms.

In the views showing the arrangement of the turret lathes will be noticed several long wood guards which drop over the running bars of stock. These guards completely cover the rapidly rotating material and yet in no way interfere with the operation of putting in fresh stock, as they are open at the bottom for the entire length. For the machines handling the heavier work these guards are suspended by two weighted cords passing over grooved pulleys above and may be easily raised and lowered when necessary.

Heavy bar material of all kinds for various departments is stored in racks in the blacksmith shop until required. An electric crane there handles the stock with facility, and several cold saw cutting-off machines are utilized in reducing the bars to the desired lengths. All heavy stock for the screw machine department is received here prior to its being sent up to the turret lathes, and when wanted is very conveniently carried on the elevator in the new shop to the second floor, the car and shaft being so designed that bar stock or shafting may be rolled directly on to the car floor, and, when elevated to the proper department, rolled off again with little expenditure of time and labor.

To permit such material to be carried up horizontally by the elevator the floors are formed, at the edge facing the well, in the manner indicated in the sketch, Fig. 9, the rectangular opening or slot from the I-beams overhead, thus leaving the floor at the front of the shaft unobstructed.

At the side of this elevator shaft are provided on each floor the closets for the workmen; these closets are very neatly arranged, the enclosing wall and partition being of sheet metal, which is carried by a frame of gas pipe and painted white. In each compartment is formed in the floor a spherical depression which serves as a cuspidor and is automatically flushed at frequent intervals. The closets are well ventilated and are easily kept in first-class order.

The third or upper floor of the new shop is utilized wholly by the automatic die department, which is driven by a single-line shaft belted from a 15 horsepower motor. Figs. 12 and 13 show two groups of machines in this department, the first group being composed of millers which finish the strips of chaser steel roughed out in the planer department, cut these strips into proper lengths for chasers and perform all the other milling operations required to prepare the blanks for the cutting of the teeth. The majority of the millers in the group are Becker-Brainard of the Lincoln pattern. The machine in the foreground is a special automatic tool for hollow milling the curved surface upon which the die cam bears when closing the chasers. It has a magazine feed for the blanks and drops out the work at the rate of sixty pieces per minute. Most of the machines in Fig. 13 are special millers for cutting the chaser teeth. The lathe in the distance is employed solely in cutting hobs for the chaser millers. In this same group of tools there are also some very interesting cam-cutting machines, but these are not visible in the photograph.

We have now been over some of the features of interest in the new shop and will return to the drawing-room—passing on the way the stockroom where are kept, in addition to large quantities of small parts required in the construction of the turret lathe, the numerous tools which make up the regular machine equipment.

The drawing-room, as already noted, is on the second floor of one of the older buildings. It has a northeasterly exposure and is very well lighted and conveniently furnished, each man having, as represented in Fig. 4, a large cabinet at the side of his table for holding books, papers, and drawings to which he may wish to refer frequently. The standard drawings of machines and special drawings are made on regular drawing paper and traced, the size of sheet used for nearly all work being 20x24 inches. Occasionally, however, a

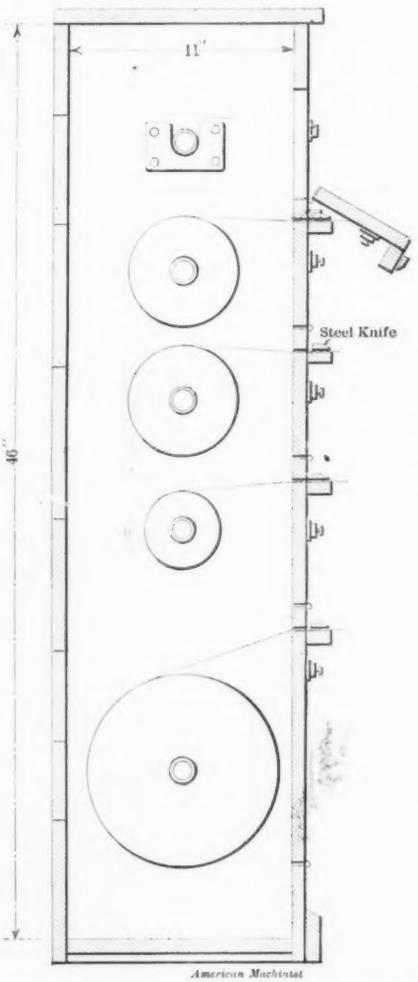


FIG. 14. VERTICAL SECTION THROUGH PAPER CABINET.

smaller sheet, 10¾x16¼, is employed. Jig drawings are made on bond paper and blueprinted. Pattern drawings are made in pencil and are entirely separate from the shop drawings. Blueprinting is done by sunlight in suitable weather, and at

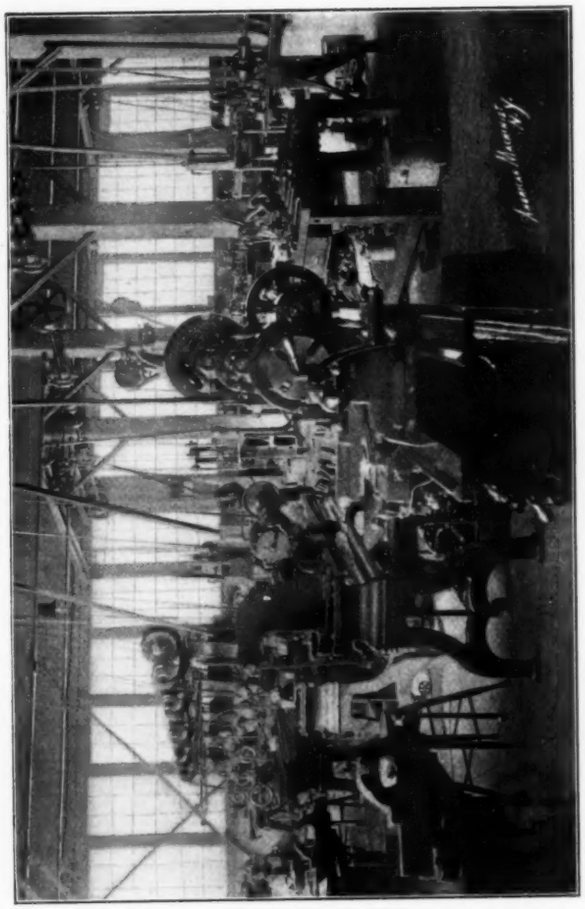


FIG. 11. A GROUP OF MOTOR-DRIVEN LATHES IN TOOL DEPARTMENT.

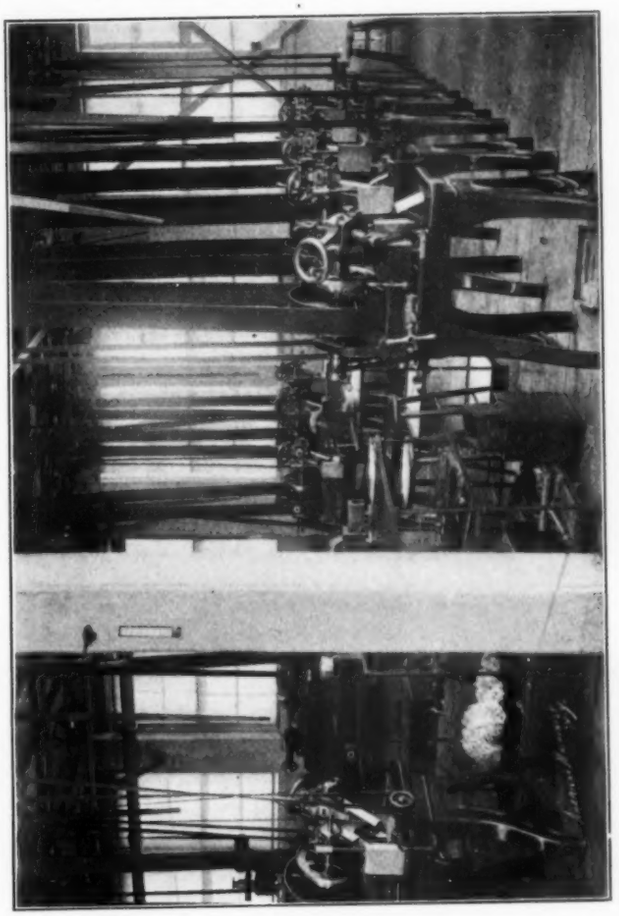


FIG. 13. CHASER CUTTERS IN DIE DEPARTMENT.

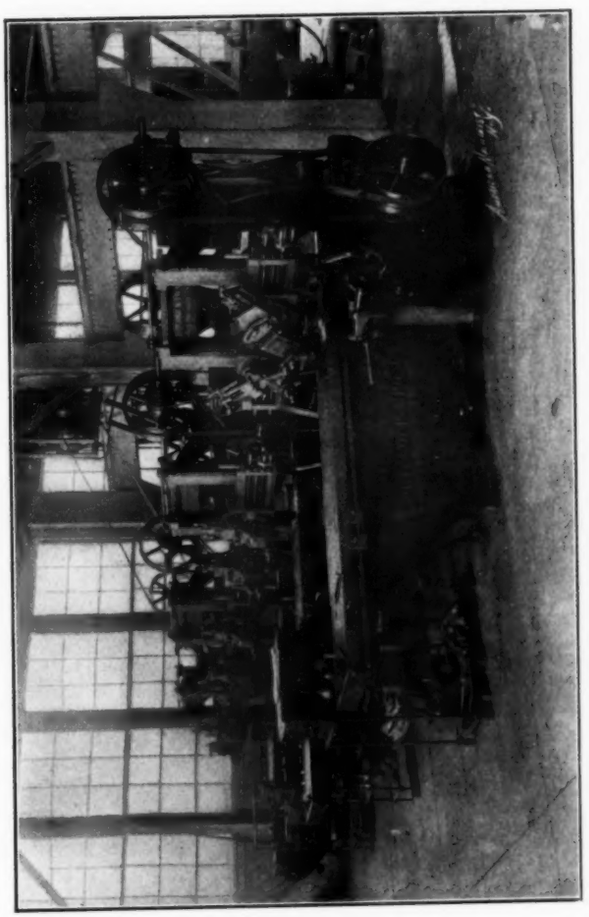


FIG. 10. A GROUP OF PLANERS WITH MOTOR DRIVE.

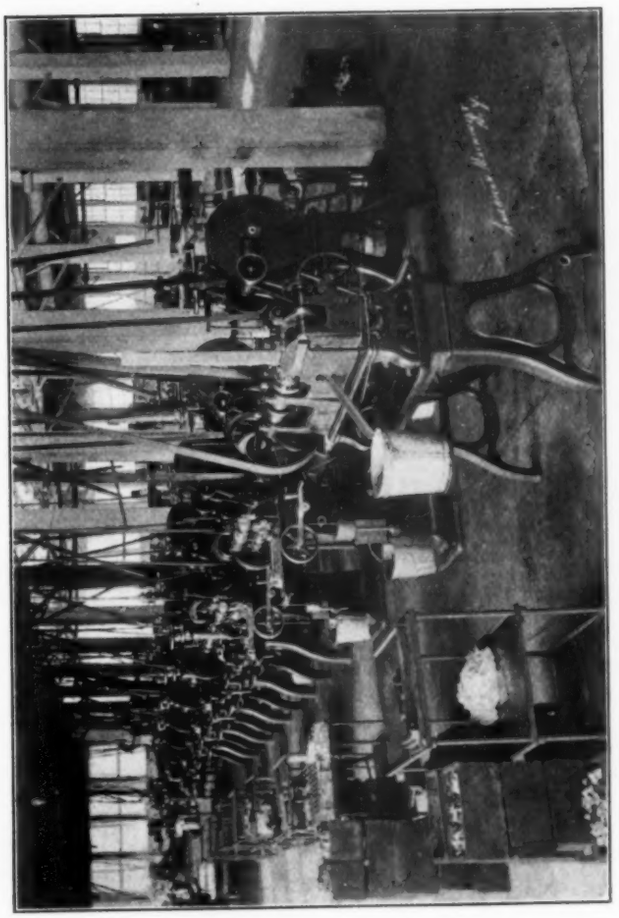


FIG. 12. CHASER MILLERS IN DIE DEPARTMENT.

other times under electric light with a blueprinting machine. A blueprint from every tracing is kept in a fireproof vault, so that a complete record of everything built may be preserved intact; and all pattern drawings as fast as the patternmakers are through with them are also stored in the vault.

For the convenience of draftsmen and foremen who wish to consult such drawings, complete sets of prints of the regular machines are mounted on swinging wood frames arranged in two revolving reels or racks which are carried by a pipe passing from floor to ceiling. The reels are counterbalanced and may be easily drawn up on the vertical standard so as to be out of the way, or dropped to convenient position by means of a cord. Each reel or set of frames carries about 150 prints, and these are arranged to bring in order, say, a drawing of the machine bed, then the drawing showing all the details applying to that member; then a head assembly drawing followed by the prints of the different head details, and so on. A few of these swinging leaves will be noticed in the half-tone showing the drawing-room, one of the mounted prints representing the opening die used with the flat turret lathe.

In the foreground of the photograph is shown a portion of a paper cabinet which seems to be very conveniently constructed, it taking care of five different rolls of material. A vertical cross-section through the cabinet is given in Fig. 14, and very little is required in the way of an explanation to make the arrangement clear. The doors or flaps drop down to admit the rolls which are dropped into sockets at either end of the case and the end of the paper is drawn out under a steel strip which is so pivoted at the ends that its sharp outer edge is always resting upon the exposed surface of the paper. The paper or tracing cloth as it is required is drawn out to the desired length and then simply torn off along the steel straightedge.

In connection with the drawing-room a library of technical books is maintained, the shopmen having access to this and being allowed to retain any book for a period of two weeks. And in addition to these books are kept on file current volumes of the leading technical journals published in this country and in England.

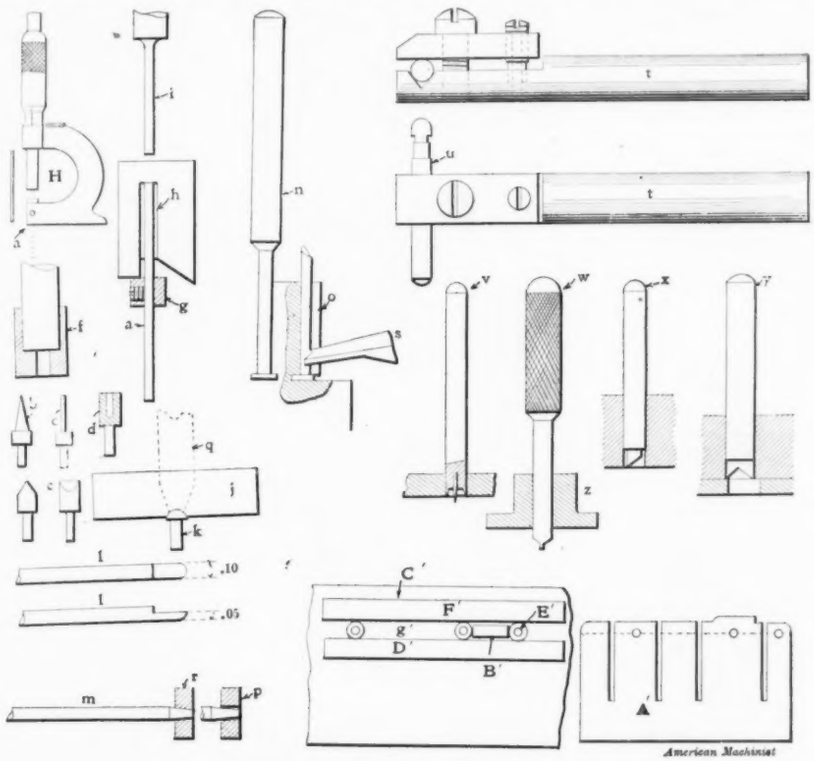
F. A. S.

A short time since, at a mine where the man at the hoist lost control of the engine, in the belief that the lives of men were in great danger, he promptly seized a large wrench and jammed it into the gearing of the hoist. He wrecked one side of the machine, destroying the gearing, but he brought the skip to a standstill. Subsequently it was learned that men who had been at work in the shaft had gone up to a level above, but he acted promptly on impulse, and of course he did right.

Some Small and Handy Machine Shop Devices—Micrometer Accessories—Staking Tool—Turning Taper Points—Milling the Corners of Teeth—A Cross Tool Holder—Locating Holes, Etc.

BY F. J. LE CARD.

Anyone using a Massachusetts Tool Company's micrometer *H*, which has a depthing gage feature, can easily make a few convenient accessories. Pieces can be inserted in the hole in the anvil made for the depthing pin, as seen at *a*, and quite a number of special measuring requirements will be met. When a bench lathe with spring chucks of different sizes is at hand, any convenient sized drill rod, say ⅛ inch, can be easily used for turning both ends of different shaped measuring tips, such as *b*, *c*, *d*, *e*, etc. A sleeve like *f* can be used on the spindle of the micrometer, and a piece like *d* can be used for shouldered work, such as pinions, or for holding one of a pair of knife-edged thread gage points like *e*, the one in *f* being allowed to swivel.



SMALL AND HANDY SHOP DEVICES.

A collar *g* on the pin *a* admits of measuring in odd places similar to *h*. The micrometer spindle can be set at any desirable line and the pin *a* brought up to it, and collar *g* fastened. The other points should be made of a length to meet the end of the spindle at some easy distance to calculate from, such as a quarter of an inch or three-eighths of an inch.

The point or rod *i* represents the spindle of a Starrett micrometer which I ground down for use in limited spaces.

* * *

To make a staking tool for a rivet head *k*, as seen by the dotted lines *q*, file an arc of a circle in the edge of a piece of sheet metal. Get the diameter of the circle, if needed for any other purpose, by laying a twist drill or a piece of drill rod in the arc, or by rolling a round file in the same and getting its diameter with a drill gage at the place where it fits the arc. But for this particular work, for a rivet head or anything similar, file or turn a tool in the lathe similar to *l*, using the templet *j* to get the shape. Be sure to file or mill the tool just to the center, as .05 inch if the tool is made on .10 inch rod. It can be easily measured for thickness with the micrometer. The stake *q* can be made to cover more of the rivet head than shown, but it should be smaller than *k*, to prevent marring the work if tipped to one side.

* * *

In turning pins *m* with taper points in quantities, and accurately, several things are to be noticed. In getting the tips *exactly* alike, a gage like *r* fitting the taper is essential. One with a straight hole like *p* is a delusion and a snare. If the length over all is important, as well as the diameter at the point of the taper, then the pins should not be cut off to length at first. Why? Because in doing the work in a bench lathe, with a spring chuck and draw-in spindle, as it is assumed now, end gaging is inaccurate when a stop is used in the back of the chuck. The reason is that when the chuck is closed tighter, or, more perceptibly, when the wire is a little smaller, the work is drawn in farther and made longer over all and the taper shorter, or *vice versa*. This is why for accurate end work three-bearing lathes and thrust spindles are used. Again, the nearer the taper comes to straight the

easier it is to take off too much stock and let the pin through the gage.

* * *

In connection with taper turning, it is well known that after the slide-rest is set by the index to any angle, or the lathe centers moved for turning a taper, the turning tool must have its cutting point on the center line, too. To set a tool to the center for turning a taper, cutting a screw thread, etc., hold a piece of any kind of rod in the chuck and with the tool to be used turn it to a point, or until the center vanishes. It is easy to see in this way when the tool is actually cutting on the center line. This is done quite easily when the adjustment up and down is made with a screw, or, as in the Rivett lathe slide rest, with an eccentric tool holder; but it is not so easy with a rocker adjusting tool-post. For very light short cuts on Bessemer or tool steel, kerosene oil gives a nice finish and is not so mussy as lard or other heavy oil. The tool must be stoned often with an Arkansas slip to do dead smooth work.

* * *

I had some brass wheels and pinions to clean out recently at the bottoms of the teeth, which were cast brass. They were cast on to a plane surface, and after the teeth were milled part way for a starter it was intended to finish them in a shaper. To get clearance at the bottoms or ends of the teeth next to the solid seat, I used a milling tool or router as shown at *n*, *o* and *s* on the rough casting. I ran the tool quite fast in a light drill press and pushed it to the cut with a forked rod held in one hand as the other moved the work to place.

* * *

A right-angle tool holder for bench or engine lathe is useful in many cases, either parallel with the center line of the lathe or at right angles to the same as used for boring. The one marked *t* I use a good many times in a Rivett lathe slide-rest and a milling attachment. The tool shown at *u* makes a perfect one for sinking into brass work and cutting a fillet to any given radius.

* * *

For transferring and locating holes in wood accurately for screws or dowel pins, tools like *v* and *w* are all right. I had some pieces lately to get in position on a hardwood seat or bottom of a glass case, where everything had to be done by hand. I used *v* for marking the wood and cutting the circle to start with. Then I followed the center with top and bottom drills like *w*, using the collar *z* held in the thumb and forefinger to sink the drill perpendicularly. The cutter lips are filed rank like an auger's.

The transfer tool shown at *x* is good for marking circles too small for dividers. A pointed piece can be used first to find the center and locate the guide block. A tool like *v*, with flush center, solid, can be used for the same purpose. *y* is a drill for opening a hole on one side, and hugs the cutting side.

* * *

My experience with a filing jig *A* may be of service to someone, so I relate it. For making a number of pieces to limits to admit of milling tools or punches and dies, a pair of templets with hardened edges are frequently used for filing by; much to the disadvantage of the files. Harden as little of the edge as possible to satisfy the requirements. Heat the edges, where the metal is too thick to harden, between oiled plates in a lead bath. Use charcoal dust on top of the hot lead to prevent the work from oxidizing. Then, if the edges curl or the holes spread, anneal the pieces and slot them, say 1-32 inch, as shown. Then the work can be brought to place by squeezing it in a vise. Fill the slots with metal slips, all but the one being closed or opened. Open with a wedge. The narrow slots do not interfere with the filing. If desirable, the slots can be put in before hardening at all, as the stock will be soft below the filing edges. Work like this, or drill rod turned, which springs in hardening, if annealed and rectified, hardly ever springs much on the second hardening. To get the three holes in line, drill one, say *F*, put a shoulder pin in this, then between parallel slips *C D*, soldered or clamped, locate a bushing *E* or ring rather, at the right distance by use of pin *B* gaged with the micrometer to the distance between centers, less the diameters of *F* or *E*, which are the same. Then get the third hole *G*, or as many as wanted, in the same way. By having the rings higher than the slips the former can be easily held with a touch of solder, and afterwards the whole can be easily melted and cleaned off.

Compressed Air and the First Hudson River Tunnel.

We have previously alluded in a brief paragraph to the passage of men from shore to shore through the first tunnel under the Hudson River from New York to Jersey City. The tunnel is not yet completed, and when all the work upon it is finished it will still have some time to wait for the completion of its twin and parallel tunnel before it can become of much practical use. Another tunnel under the East River from Manhattan to Brooklyn is being rapidly pushed and several tunnels under each river are planned and some of them contracted for, so that in a short time this means of communication will be an important feature of the daily life of the metropolis. It is not unreasonable to suppose that when all these tunnels are completed and in full and constant service with the appreciation of them will come some remarks and questionings as to why they have not been built before.

The history of the construction of this first tunnel affords some answer to this. The tunnel was begun thirty years ago, and with our present facilities and methods it could and should have been completed in two or three years. Much, however, had to be learned of the problems of tunnel construction in detail, and much has been taught all future engineers by the difficulties and their solutions which have developed in this arduous undertaking. There has been more than one long period of delay for the bracing-up process which capital often requires in large and unusual undertakings. Compressed air was used from the first, and it has been the one indispensable agent throughout, but even in the art of and the apparatus for air compression there have been great improvements, so that while the work is being completed by the aid of compressors from the same builders, the Ingersoll-Sergeant Drill Company, as the compressor employed at the beginning of the job the first and the latest machines are quite different in construction and in one essential feature of their operation.

The compressors first used were of the water injection type, the idea being to cool the air or to prevent as much as possible its temperature from rising during the compression, and this is still *theoretically* all right; but the theory which approves of it is that which, as often happens, does not include all the practical conditions involved. Experience disapproves of these compressors and has driven them out of the market. On this tunnel work these compressors have been replaced by newer machines with poppet inlet valves and water-jacketed cylinders, a complete equipment of modern Ingersoll-Sergeant compressors having been installed a couple of years ago when the work was taken up by the Hudson Improvement Company. The Jersey City power house contains four compressors, one of the Class H duplex type with steam cylinders 16 inches in diameter, air cylinders 20¼ inches in diameter by 16 inches stroke, and three of the Class A Straight Line type with 22-inch steam cylinders and 24-inch stroke. Of the latter, two have air cylinders 26¼ inches in diameter and the other an air cylinder 22¼ inches in diameter. The equipment at the New York power house, at the foot of Morton street, includes two duplex Class H compressors similar in size to the one at the Jersey end of the tunnel and one Straight Line, Class A, machine with steam cylinders 22 inches in diameter, air cylinders 22¼ inches in diameter and 24 inches stroke. Now that the first bore is completed, as far as the compressors are concerned, these machines are being used in building the parallel tunnel.

The right tool for the job is always the best tool, and *vice versa*. Don't use either a monkey-wrench for a hammer or a hammer for a monkey-wrench.

There may be some reasonable ground for differences of opinion about piecework, but there can be none about spitework.

A Great Feat in Shaft Straightening.

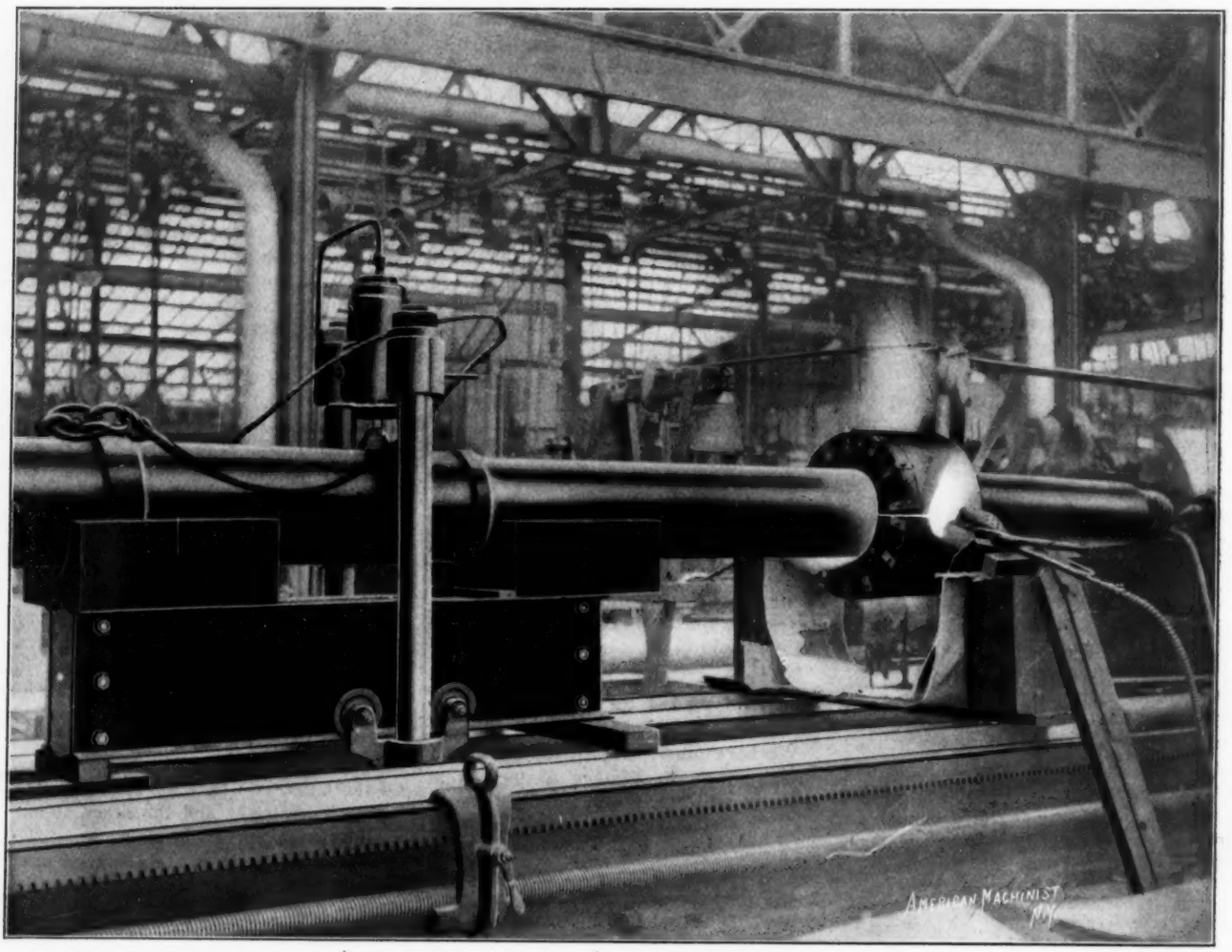
EDITORIAL CORRESPONDENCE.

Considerable has been published of late in the daily press about the accident to the "Illinois'" tail shaft. That a tail shaft had been bent and straightened was probably enough for the average layman, but as such meager information would hardly satisfy those interested in mechanical matters I decided to call at the office of the commandant of the Brooklyn Navy Yard and get some data as to how this difficult job was done. The commandant referred me to Captain Smith, Chief of the Engineering Department, and I wish here to express my appreciation of the kindly courtesy shown me by Captain Smith.

It seems that in maneuvering the "Missouri's" stem fouled the port propeller of the "Illinois," tearing away the upper strut, damaging the blades of the propeller and bending the shaft near where the taper seat for the propeller begins. The propeller having lost the support of the upper strut, sagged apparently about 12 inches. The Department in Washington was of the opinion that the straightening operation, if possible at all, could not be done outside of the great steel mills, and as a precautionary measure got bids for a new shaft. Captain Smith, however, did not agree with the department and stated that if it could be straightened at all, he could do it, and in any case it would be well for the Department to know what could or could not be done at the Brooklyn Navy Yard.

The shaft is 53 feet long, 16 inches in diameter, with a 9-inch hole reaching the entire length of the straight part, the hole in taper part being reduced to 4 inches. After considerable trouble (caused by the flange which had to be removed) the shaft was taken out and brought to the shops. Two lengths of the bronze casing were removed by planing a groove on one side, splitting them from end to end. This job itself was done in rather a unique manner owing to its great length and enormous weight, the shaft was laid on the flooring and the tool was fastened in a suitable slide secured to the end of the planer table. These two lengths of casing were immediately over the bent portion of the shaft. On placing the shaft in the steady-rests in the lathe it was found to be 3½ inches out of true. A sheet-iron furnace was improvised and with charcoal as fuel the shaft was heated to a moderate red heat. This took several hours, and when ready the shaft was put into a Watson-Stillman press and subjected to pressure to take the kink out; it was then allowed to cool over night (it takes special legislation to work overtime at the Navy Yard) and on being put in the lathe next morning was found to be only about ½ inch out of straight.

While in position in the lathe it occurred to Captain Smith that it would be less trouble to apply the heat without removal from the lathe, so the boilermaker made the sheet-iron furnace in halves, which is seen in position in the illustration. The heat for this was obtained from a Buckeye oil furnace, four jets of flame playing on either side of the shaft within the iron box.



A GREAT FEAT IN SHAFT STRAIGHTENING.

A rather interesting thing about this iron box is, that the boilermakers asserted that it would be burnt out before the job was completed, owing to the fact that it was not lined with a non-conductor of heat; this was, however, not the case, the box being in good condition when the job was completed.

The Watson-Stillman 130-ton press is shown resting on the lathe bed and supporting the center of the shaft upon two gray-iron bearing blocks; the extreme end of the taper end of the shaft may be seen

resting upon blocking on the lathe bed to the right of illustration. As soon as the desired heat was obtained the oil furnace and sheet-iron box were removed (in less than two minutes), the electric traveling crane picked up the part of shaft supported by the Watson-Stillman press, the press was moved forward, a semi-circular piece of metal placed on top of the shaft for the press ram to bear upon, and the pressure applied. Altho the rated power of the press used is 130 tons, the makers assured Captain Smith a pressure of 175 tons would not injure it. An ultimate pressure of 160 tons was put on the shaft, and by successive heating and bending the shaft was brought within 1-32 inch of straight, which is as near as anyone could desire. The shaft was finally put in the lathe and a light cut taken off it, this being necessary in order to see if any defects had developed. The two lengths of casing which had been made in the meantime were then shrunk on and the job was completed. The joints between these new lengths of casing compare very favorably with those on the original casing lengths.

Captain Smith gives great credit to his master machinist, Samuel Irwin, for the way he carried the work through. The elapsed time on this job was four working days. Captain Smith assured me he could straighten another similar shaft in two days. E. A. S.

A Beer-Proof Alloy.

A patent has recently issued to Stephen Kneppel, Scranton, Pa., for an alloy of the following composition by weight: Babbitt metal, 2 parts; aluminum, 6 parts; zink, 1 part. The composition of the babbitt metal as given is: Tin, 96 parts; antimony, 8 parts; copper, 4 parts. In making the alloy the babbitt is first melted and the aluminum is added, the heat being applied until the aluminum is all melted. The application of heat is then discontinued and the zink is added. The following is said of the metal thus produced: "The resulting alloy is a bright lustrous metal, comparatively light in weight and having considerable tensile strength, and is very desirable for the purpose of forming vessels intended to contain lager beer, such as beer vats, coolers, kegs, pipes, etc. At present such vessels are usually made of wood, iron or copper, and these vessels and the beer act injuriously upon one another. The wood decays and the iron or copper vessels oxidize, and in addition to affecting the beer a great deal of scouring is required in order to keep the vessels clean. The beer and my alloy do not act injuriously upon one another, and the alloy is kept clean with comparatively little labor. Its lightness and strength make it suitable for transporting beer."

And now the Philadelphia mint has made a new record, having recently melted 12 tons of gold in one day.

Report of a Committee to Co-operate in Standardizing Abbreviations, Symbols, Punctuation, Etc., in Technical Papers.

The following we reprint from an advance copy of a paper prepared for the September meeting of the American Institute of Mining Engineers. It is sent out at this early date (subject to revision) for the purpose of stimulating discussion and suggestion:

This committee is the result of a desire of the authorities in charge of the publications of the four national engineering societies to co-operate in this matter.

The members of the committee are the following: Charles Warren Hunt, secretary American Society of Civil Engineers; D. S. Jacobus, vice-president American Society of Mechanical Engineers; Joseph Struthers, assistant editor, American Institute of Mining Engineers; Cary T. Hutchinson, chairman of the Editing Committee, American Institute of Electrical Engineers.

This committee has held several meetings; it seemed advisable, at the outset, to limit its discussions closely to the general subject of abbreviations. Further, it seemed best to formulate a few general rules to be followed in making abbreviations, rather than to compile a list of forms to be recommended.

The committee decided to limit the subject more narrowly by considering only abbreviations to be used in the text, or general reading matter, and not those to be used in special matter, such as columns, box-headings, plates, figures, etc. The rules that follow are intended to apply to the text, and not primarily to such special matter. This committee is of the opinion that it is impracticable to make general rules applicable to special matter; it believes that the rules herein stated should be followed as far as possible even in special matter, realizing, however, that clearness is of the first importance, and that all rules must be secondary to that consideration.

Referring, then, to abbreviations in the text or general reading matter, the committee recommends the observance of the following rules:

1. Use abbreviation only after nouns denoting a definite quantity. Example: "The power plant has a capacity of 10 h.p.," not "10 horse power"; but, "The capacity of the plant, in horse power, is ten."

2. Do not abbreviate abstract or descriptive words. Example: "horizontal return tubular boilers," not "h.r.t. boilers."

3. Use lower case characters for abbreviations. An exception to this rule may be made in the case of words spelled normally with a capital. Example: "B.t.u." and not "b.t.u." or "B.T.U." (British thermal unit), "U. S. gal." (United States gallon), "B. & S. gauge" (Brown & Sharpe gauge).

4. Use a period after each abbreviation. In a compound abbreviation, do not use a space after the period. Example: "i.h.p." and not "i. h. p." (indicated horse power).

5. Use a hyphen to connect abbreviations in cases where the words would take a hyphen if written out in full. When a hyphen is used, omit the period immediately preceding the hyphen. Example: "3 kw-hr." and not "3 kw.-hr." (3 kilowatt-hours).

6. Use all abbreviations in the singular. Example: "17 lb." and not "17 lbs." (17 pounds), "14 in.," not "14 ins." (14 inches).

7. Never use "p." for "per," but spell out the word. Example: "100 ft-lb. per ton" (100 foot-pounds per ton); "60 miles per hr." (60 miles per hour).

8. Use decimals, as far as possible, in place of vulgar fractions. Example: "1.25 ft.," not "1¼ ft."

9. In general, spell out an adjective qualifying the name of a unit. Example: "Boiler h.p." (boiler horse power). The exceptions to this rule are—"i.h.p." (indicated horse power), "e.h.p." (electric horse power), "b.h.p." (brake horse power), "e.m.f." (electromotive force), "m. m.f" (magnetomotive force).

10. Use "Fig.," not "Figure." Example: "Fig. 3," and not "Figure 3."

11. In all decimal numbers having no units a cipher should be placed before the decimal point. Example: "0.32 lb.," not ".32 lb."

12. In the notation of large numbers, use "en" spaces instead of commas. Example: "1 520 125," not "1,520,125."

13. Use the word "by" instead of "x" in giving dimensions. Example: "8 by 12 in.," not "8 x 12 in."

14. Never use the characters (′) or (″) to indicate either feet and inches, or minutes and seconds as periods of time.

The following forms are given as illustrations of these rules, and are recommended to be used:

Name.	Abbreviation.
Inches	in.
Feet	ft.
Yards	yd.
Miles	spell out.
Pounds	lb.
Grains	gr.
Tons	spell out.
Gallons	gal.
Metres	m.
Millimetres	mm.
Centimetres	cm.
Kilometres	km.
Kilogrammes	kg.
Grammes	g.
Milligrammes	mg.
Kilogramme-metres	kg-m.
Metre-kilogrammes	m-kg.
Seconds	sec.
Minutes	min.
Hours	hr.
Linear	lin.
Square	sq.
Cubic	cu.
Per	spell out.
Fahrenheit	fahr.

Name.	Abbreviation.
Centigrade	cent.
Percentage	% or per cent.
Volts	spell out.
Ohms	spell out.
Watts	spell out.
Kilowatts	kw.
Kilowatt-hours	kw-hr.
Watt-hours	watt-hr.
Amperes	spell out.
Brake horse power	b.h.p.
Electric horse power	e.h.p.
Indicated horse power	i.h.p.
British thermal units	B.t.u.
Gramme-calories	g-cal.
Kilogramme-calories	kg-cal.
Magnetomotive force	m.m.f.
Electromotive force	e.m.f.
Revolutions per minute	rev. per min.
Circular mils	cir. mils.
Miles per hour per second	miles per hr. per sec.
Candle-power	c-p.
Watts per candle-power	watts per c-p.
Mean effective pressure	spell out.
High pressure cylinder	spell out.
Diameter	spell out.

The members of this committee have agreed to recommend the authorities in charge of the publications of the four national engineering societies to follow the rules given herein in their respective publications, as far as possible.

(Signed) CHARLES WARREN HUNT,
D. S. JACOBUS,
JOSEPH STRUTHERS,
CARY T. HUTCHINSON.

New York, March 11, 1904.

Note by the Secretary of the American Institute of Mining Engineers.—The foregoing report, though informal and tentative, is published in pamphlet form for the information of members, from whom criticism is invited. By the authority of the Council, all matters of style, punctuation, typography, etc., are left to the discretion of the Secretary, as Editor of the *Transactions* and other publications of the Institute; and in the use of this discretion, the Secretary has for many years followed a general system, sufficiently elastic to permit some concessions to the wishes of authors, in matters not essential. The desirability of uniform practise with regard to the points embraced in this report is recognized; and the Secretary, while reserving the privilege of individual action, is glad to say that the recommendations of this Committee of Consultation represent, in most particulars, his own practise hitherto, and that most of the recommendations of the committee which involve a departure from that practise, he would be willing, for the sake of uniformity, to adopt, if they should be adopted by the editors of the sister societies concerned. To this statement, he is disposed at present to make the following exceptions:

1. He is not willing to discard the use of commas in the notation of large numbers, as recommended in No. 12 of the committee's suggestions. This does not refer to the arrangement of tabular matter, the consideration of which is disclaimed by the committee. His reasons need not be amplified here; but the following among them may be briefly stated:

(a) The comma would probably still be used, in the notation of numbers under 1,000,000; and the substitution of an "en" space in larger numbers would be an unnecessary employment of two ways of signifying the same thing.

(b) The abandonment of this use of the comma is not called for, unless the comma is to be the "decimal-point," as in some foreign literatures. Since American usage employs the period as the "decimal-point," the present general use of the comma in notation need not be disturbed.

(c) The attaching of significance to a simple space in printed matter, as proposed, is objectionable, because a space may be due to the dropping out of a type—an accident which, as all proof-readers know, may happen to a "form" after the last editorial revision. It is true that the "en" space, specified by the committee, is too narrow for an ordinary figure; but the difference between an "en" and an "em" space is easily overlooked by the printer, and even by a hard-pressed proof-reader. (In the proof of the above report, as it came before the Secretary, the printer had introduced at this point the larger space). Now, for equal final accuracy, the system which makes the proof-reading easiest is to be preferred.

2. In the designation of thermometer-scales, the use of "fahr." for Fahrenheit, and cent. for centigrade, as given in the committee's list of illustrations, is objectionable. These terms fall within the exception stated by the committee under No. 3. The three thermometer-scales are those of Fahrenheit, Celsius and Reaumur; and the abbreviations denoting them should begin with capital letters. Indeed, the capital letters, combined with the symbol indicating degrees (° F, ° C and ° R), are quite sufficient and unmistakable.

[The above paper should be of interest to more of our readers than almost any other that we could print, because it comes in the way of almost everyone who has any recording or computing to do to use abbreviations, and many misinterpretations and misunderstandings would be avoided and much time would be saved if there were but one universally adopted symbol or form of expression for each particular case. There is of course opportunity for differences of opinion as to many of the recommendations of the committee, and now is the time to state them.—Ed. A. M.]

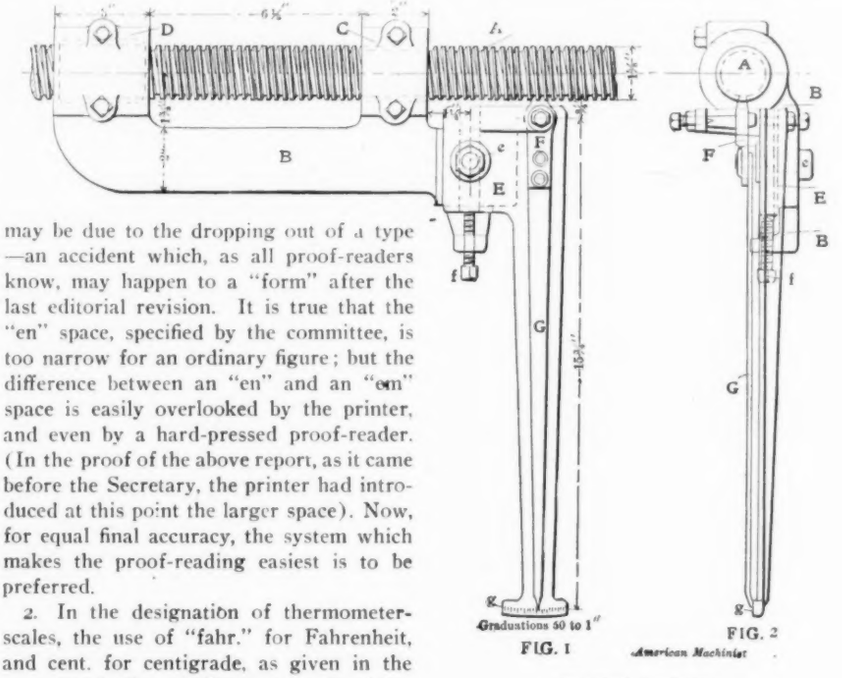
Testing a Lathe.

BY OSCAR E. PERRIGO.

In this article it is proposed to consider particularly the inspection of the ordinary screw-cutting engine lathe, and to give such description and illustrations of the necessary apparatus and methods of procedure as will insure the degree of accuracy that is now demanded in this class of machine tools.

The special tools necessary for determining the accuracy of an engine lathe must, of course, be accurate and reliable, but they need not for this reason be elaborate or expensive, as the illustrations accompanying this article will readily show. Their description and use will be fully explained as the process of inspection is proceeded with in the matter which follows.

It is assumed that the lathe bed, as well as the headstock, tailstock and carriage have been properly planed, the V's shaped to the proper angle, and that the V's of the bed have been scraped straight and true, removing as little of the metal as possible. The headstock, tailstock and carriage should now be carefully scraped to fit the V's of the bed. Their fair bearing may be easily ascertained by rubbing on a little of a mixture of the dry, red pigment commonly known among painters as "princess red," or some similar dry color, mixed with a small portion of any oil that may be convenient. The above color will be found to have this convenience: it will show almost black where the pressure is very severe and correspondingly lighter where the contact is less perfect. The scraping should be continued until the contact spots do not exceed ¾ inch from center to center, and the inspector should assure himself of



TESTING A LATHE.

this fact before these parts are finally fixed in position.

The carriage should be run back and forth along the length of the bed to detect any slight curves that the bed may have taken since it was planed, and if any are found they should be corrected by scraping. Of course, the bed should be carefully leveled up and kept so during the time this scraping and fitting is going on.

When the lathe is finally "set up" or erected, great care should be taken to have it on as firm and immovable a foundation as is possible, and this requirement be-

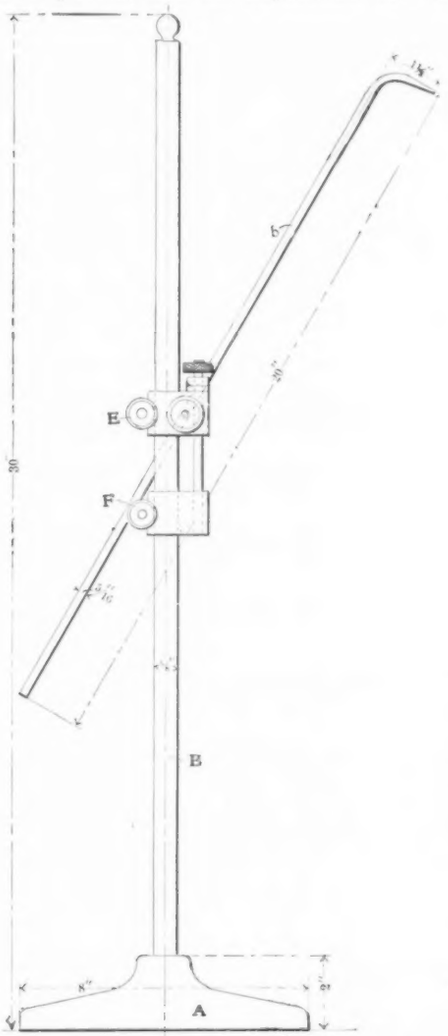


FIG. 3

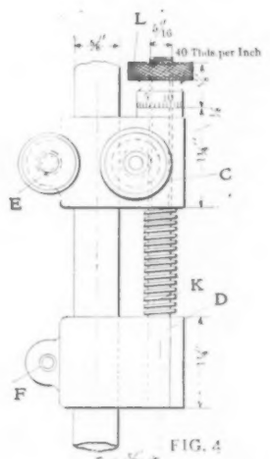


FIG. 4

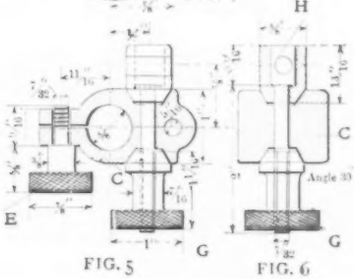


FIG. 5 FIG. 6

American Machinist

TESTING A LATHE.

comes all the more important as the lathe is larger and heavier. The bed should be carefully leveled both longitudinally and laterally, applying the level on the tops of the V's at points not over 4 feet apart for large and heavy lathes, and not over 3 feet for small and medium sized ones. If this is not carefully attended to it will be difficult to determine with any reasonable degree of accuracy whether or not the lathe will bore truly, as by a slight change in the tops of the V's, throwing them out of a true plane will defeat this test. Neither can proper tests by means of the carriage be made if the V's on the bed are not so carefully leveled up as to be correctly in the same plane.

Before proceeding to further describe this system of lathe testing, attention is called to the accompanying blank report for properly recording the results of the inspection. It will be noticed that it is quite thorough, but a long experience in machine tool work brings us to the conclusion that there is not a superfluous observation or requirement in it. And it is recommended that lathe builders send a signed copy of this report to the customer who purchases the lathe. There are many items of an inspector's duty not here enumerated which, in a shop properly arranged and managed, will have been attended to as the parts are being made and assembled. This relates only to the performance and outward condition of the lathe when ready for its final inspection.

Lead screws should be tested before they are put into the lathe of which they are to become a part. They should be held on centers, and may be tested for accuracy of thread by the device shown in Figs. 1 and 2, in which *A* is the lead screw to be tested, upon which is applied the main frame *B* of the device, supported by its capped bearings *C*, *D*, the former just fitting over the top of the thread and the latter having either a babbitt metal lining cast upon the thread or being provided with a split sleeve in which this babbitt nut is cast. The latter arrangement is best, particularly when lead screws of different pitches or different diameters are to be tested. In case of different diameters, the bearing *C* should also be bored large enough to allow of a suitable bushing being introduced. The frame *B* of the device is extended to the right to form a grooved support for the adjustable arm *E* secured by the bolt *e* and adjusted by the screw *f*. This arm is extended to form a graduated segment at *g*. Pivoted in the arm *E* is the indicating lever *F*, whose front end is formed to fit the thread of the lead screw *A*, and to whose rear end is fixed the indicating arm *G*, whose point rests on the graduations at *g*. The leverage and graduations are so arranged that thousandths of an inch are indicated by lines, and a much smaller fraction may be readily perceived. In using this device that portion of the frame *B* between the bearings *C*, *D* rests on the top of the compound rest, the lathe being arranged for the same pitch as the lead screw to be tested. The screws holding down the caps of the bearings *C*, *D*, are set up just close enough to insure a proper fit. The object of using a babbitted nut in the bearing *D* and applying the indicating lever *F* at some distance from it is threefold. The influence of the lead screw of the lathe in use is not felt, there is very little friction on the point of the indicating lever *F*, and the relative inequalities of the thread of the lead screw to be tested are rendered more obvious.

Another very important and useful instrument in lathe testing is the micrometer surface gage, which is shown in Figs. 3, 4, 5 and 6, in which all principal dimensions are given. The base *A* is of cast iron, the supporting rod *B* and the pointer *b* are of Crescent steel drill rod, and the other parts (excepting the spiral spring) are of tool steel. Its construction is readily understood from the drawings, special attention being called to the arrangement for securing the pointer *b*, as shown in Figs. 5 and 6, by means of the conically formed thumb-nut *G*, its clamping bolt *H* and the conically formed receiver. The blocks *C*, *D*, are connected by the rod *K*, whose lower end is fixed in the block *D*, and whose upper end passes up through the block *C*, where it is cut with a thread 40 to the inch, and provided with a graduated thumb-nut *L*, by means of which we may read thousandths of an inch, and even the quarters of that fraction are readily determined. Blocks *C* and *D* are forced apart by the spiral spring surrounding the rod *K*. In the use of this device the block *D* is secured by the thumbscrew *F*. The pointer *b* is then brought down near the work and is secured by the

thumb-nut *G*.. The thumb-nut *E* is now tightened just enough to hold it firmly, and the final adjustment made by means of the graduated thumb-nut *L*.

The lathe being ready for testing and the face-plate having been faced off, we begin with the test for alinement, as shown in Fig. 7, which is a rear elevation of a lathe ready to be tested, and Fig. 8, a plan of the same. To ascertain the vertical alinement of the head spindle we place an accurately ground and properly fitted test-bar *A* in the center hole of the head spindle and place the micrometer surface gage on the lathe V's, as shown in Fig. 7, first applying the pointer *b* at a point near the face-plate and then near the outer end of the test bar, as shown by dotted lines, using the micrometer-adjusting nut *L* to ascertain the difference, if any. To render the touch of the pointer more sensitive a slip of paper should be drawn carefully between the test bar and the pointer. The best paper for this purpose is a hard calendered linen typewriter paper, three thousandths of an inch thick, as this paper runs very uniform in thickness. If the inner and the outer V's of the lathe are not of the same hight, a parallel bar should be laid across the V's and the micrometer surface gage placed upon it. In any event much care should be exercised to be sure that the gage base sits fairly on its support, as a slight scratch, or a burr, or the least bit of dirt will defeat the object of the test.

The vertical alinement of the tail spindle is tested in the same manner, as shown in Fig. 7. It may also be tested by bringing the pointer down on the spindle itself, when it is run back into the tailstock, and again when it is run out as far as it will go. It sometimes happens that we shall get a different result by sliding the tailstock to a different position on the bed. In this case we will probably find some inequality in the V's to account for it.

To test the lateral alinement of the head spindle, a bar of the size of the ordinary lathe tool, with its front end bent to a right angle, and provided with a micrometer head, is placed in the compound rest, as shown in Fig. 8, and the reading made in a manner similar to the last test. The lateral alinement of the tail spindle is tested in a similar manner, moving the carriage to the desired point.

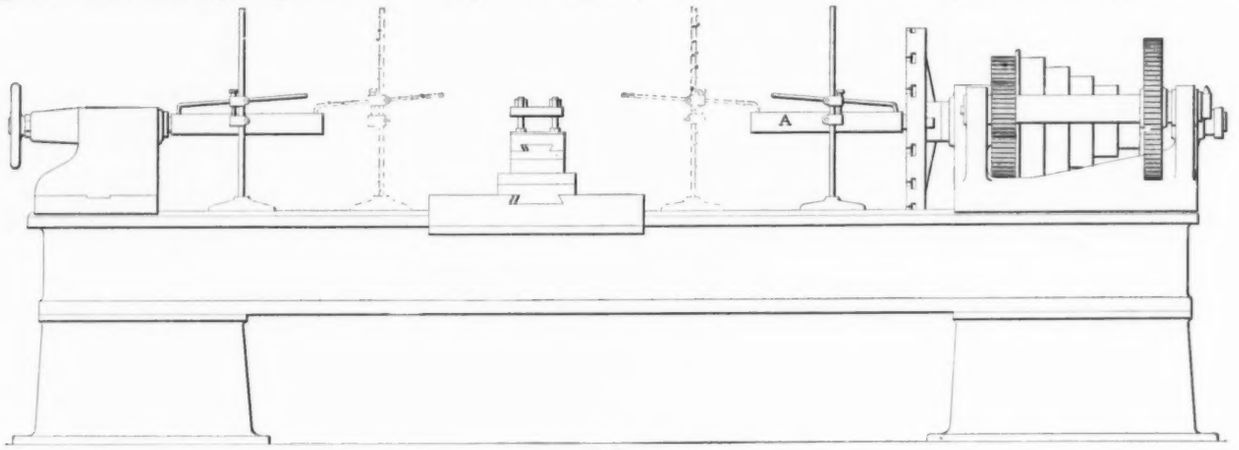


FIG. 7

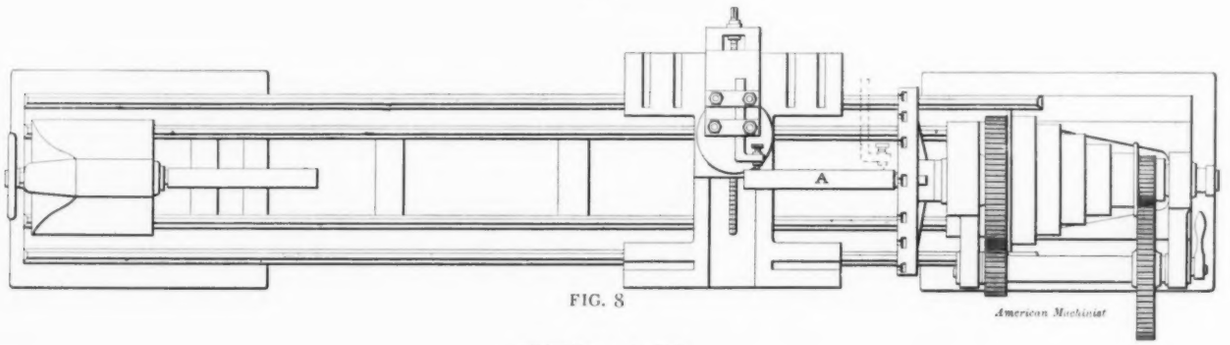


FIG. 8

TESTING A LATHE.

To ascertain the accuracy of the center hole in the head spindle, we may use our micrometer at the end of the test bar *A*, as shown in Fig. 8, and by turning the spindle a quarter of a turn at each reading we may ascertain its accuracy with certainty.

The foregoing tests would seem to be sufficient to insure the correct boring of a job on this lathe. But it must not be forgotten that the error detected by the test, as shown in Fig. 8, will be doubled in boring a piece of work. Therefore the best test for ascertaining the boring quality of the lathe will be by bolting a cast-iron test piece to the face-plate, as shown in Fig. 9. A very light cut is taken off from the raised portions *C*, *C*, and measurements taken with the micrometer. This test for boring will be much more conclusive than attempting to actually bore a piece of work, owing to the difficulty of making any boring tool, held in a compound rest, bore the same sized hole at both ends of a piece from 12 to 30 inches long. In this connection a diagram and all necessary dimensions for test pieces for different sized lathes are given in Fig. 10.

To test for the concavity or the convexity of the face-plate it is usual to use an ordinary straight-edge and three slips of paper. This may be nearly correct, but we have no means of knowing the exact amount of the error. For this reason the micrometer straight-edge shown in Fig. 11 was designed. The stock *A* is slotted at each end, and in these slots are secured the outer points *B*, *B*, capable of being adjusted to different diameters of face-plates, and are secured by the thumb-nuts *C*, *C*. The center point *D* is a micrometer head, operated by the usual milled head *E*. In using this straight-edge it is first turned up on a fixed straight-edge and the center point adjusted so that the three points are accurately in line, using slips of paper to ascertain this correctly. The test bar is now placed in the head center hole and the flat space *a* of the straight-edge laid upon it for support. Slips of paper are now introduced between the points and the face-plate. The micrometer position is noted, and then adjusted to hold the center slip of paper, when a second reading will give convexity or concavity of the face-plate.

The allowable limits of variation of lathes may be about as follows, viz.: 14-

to 20-inch-swing lathes, inclusive, .0005 inch; 22- to 28-inch-swing lathes, inclusive, .001 inch; 30- to 48-inch-swing lathes, inclusive, .002 inch; lathes larger than these, .003 inch. These limits apply to all the foregoing tests, the distances between testing points to be as given in the table, Fig. 10. It should be understood that no convexity of a face-plate is to be allowed.

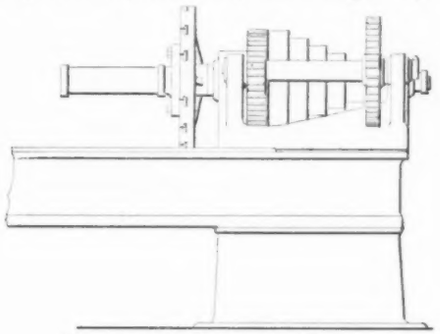


Fig. 9 Test Piece for Alignment of Head Spindle in Boring

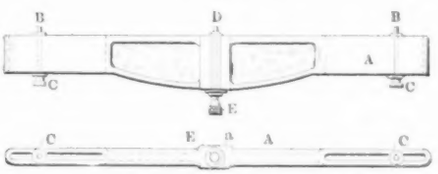
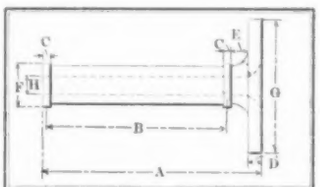


Fig. 11 Micrometer Straight-edge for Testing Face Plates



Swing of Lathes	A	B	C	D	E	F	G	H
14 and 16	14½	12	½	1	1	3	9	1⅛
18 and 20	17⅝	15	½	1¼	1	3⅛	11	1⅜
22 and 24	21⅛	18	⅝	1⅜	1⅛	4	13	2
26 and 28	24⅝	21	⅝	1⅝	1⅜	5	15	2⅜
32 and 36	27⅜	24	⅝	1½	1½	6	17	2½
42 and 48	41¼	27	¾	1⅝	1½	7	19	4
60 and 72	55	30	1	2	2	8	23	4½

Fig. 10 Form and Dimensions for Test Piece for Boring on Lathe

American Machinist

TESTING A LATHE.

The various other points of inspection as given in the report blank will need no special explanation, certainly not to men accustomed to this class of ofttimes trying and delicate work.

A short time ago we had to drill some holes through a gray-iron tank head about 1½ inches thick, and tap them for 1-inch pipe. As the available room was very limited, it was a difficult job, as it was not possible to swing the double-ended tap wrench, and by using a monkey-wrench, or a "monk," as it is commonly called, the tap is not always started squarely into the hole. After the tap had partly done its work in one of these holes, it was found necessary to "square it up" and start again. This effort was not entirely successful, as it did not stand level. It was backed out and again started, this time in proper form, and the cut was finished. When a pipe was screwed into this hole it did not stand level, consequently was taken out, held so that it must stand level and started in again. It was now level, but not square otherwise. It was given another trial, and this was satisfactory. As the tap was started in three different ways, and the pipe could be made to stand in three different directions, it seems to show that three different threads were cut in the same hole. Of course this plan is not recommended to others, as it was an accident caused by lack of room to work properly, but is stated as a rather exasperating experience.—*W. H. Wakeman, in The Tradesman.*

Richard Trevithick.

The latest of the excellent series of brief biographies of engineers issued monthly by Wyman & Gordon, Worcester, Mass., in place of the usual perfunctory trade catalog, tells of the career of Richard Trevithick, the first man to apply steam to the haulage of loads on railroads. It was written by Dwight Goddard; as here reproduced it is much abridged.

He was born in 1771 in Cornwall. His father was a purser in some of the mines, a man of some property and standing. The boy grew up without the benefits of school discipline, but his father, seeing his bent toward mechanics, placed him for a time with William Murdock, who was then setting up pumping engines for Boulton and Watt.

There was great demand about this time for engineers to set up and run the many steam engines that Boulton and Watt were building, and Trevithick very soon found employment in this work. He was tempted, however, by the profits earned by Watt's engines to construct one that would evade the Watt patent and still be successful, and he went into partnership with one Bull, who had designed a direct pumping engine.

The engine which Trevithick produced was a success mechanically, but in law-

Inspection Report on Lathe.

NAME OF COMPANY.

Inspection No..... .....Date, inspection commenced..... .....
Size of Lathe.....Date, inspection completed..... .....
Lathe prepared for inspection by..... ....
Special features of Lathe..... ....
....

1. Level longitudinally..... .. ..
2. Level laterally..... ....
3. Swing over the V's.....
4. Swing over the carriage.....
5. Distance between centers.....
6. Fitting of headstock on V's.....
7. Fitting of tailstock on V's.....
8. Fitting of carriage stock on V's.....
9. Bores, large at inner end.....
10. Bores, large at outer end.....
11. Faces..... .....concave.....
12. Head center, high at outer point.....
13. Head center, low at outer point.....
14. Head center, to the front at outer point..... ....
15. Head center, to the rear at outer point ....
16. Tail center, high at outer point.....
17. Tail center, low at outer point.....
18. Tail center, to the front at outer point ....
19. Tail center, to the rear at outer point ....
20. Center hole in head spindle.....
21. Back gears, run..... .....
22. Second back gears, run.....
23. Internal gear, runs..... .....
24. Feed gears on head, run.....
25. Compound rest bevel gears, run.....
26. Apron gears, run.....
27. Rack pinion works.....
28. Lost motion in apron gears.....
29. Reverse device in apron..... ....
30. Lead screw..... .....
31. Tail spindle screw fits.....
32. Cross feed screw fits.....
33. Comp. rest screw fits.....
34. Appearance of scraped surfaces.....
35. Appearance of polished surfaces.....
36. Finished corners properly rounded....
37. Width on cone steps.....
38. Charge gears fit studs properly.....
39. Wrenches fit properly.....
40. Squares for wrenches of uniform sizes ....

Remarks..... ....
....
....
....
Signed..... ....
Inspector.

suits with Watt his firm was defeated, and the partnership was dissolved.

The Watt patent expired in 1800, but Trevithick had already entertained the idea of using the expansive force of steam directly without the intervention of a condenser, and embodied his improvements in a patent that he received in 1802, for "the application thereof for driving carriages and for other purposes." This was the first practical use of high-pressure steam without condensation.

Trevithick used a cylindrical wrought-iron boiler, similar to the one previously used by Evans in America. Such boilers were long afterward known in Cornwall as Trevithick boilers. So economical were they that one company gave him a present of $1,500 in acknowledgment of the benefit they had derived from their use.

The piston of the engine worked in guides and was fastened to a crosshead. This crosshead was connected by two side-rods to another crosshead on the other side of the shaft and the connecting rod was fastened to the second crosshead. The shaft was connected to the wheels by toothed gears. The carriage was capable of seating a half dozen, and under it was the enclosed engine. It rested on four wheels, only the two in the rear being driven. He used a fan for blast, but also exhausted his steam into the chimney. His patent speaks of making the periphery of the wheels rough or toothed, but adds that a smooth wheel "in general will be found to answer the intended purpose."

In 1803 the first steam carriage was built, and run about the town very successfully as long as steam could be kept up. The success was so great that it was decided to take it to London, where it was so successful that it became the talk of the town; suddenly, however, Trevithick withdrew the engine, sold the carriage to one man and the engine to another, and returned to Cornwall. What his reasons were, no one knew.

The same year, 1803, he went to Pen-y-darran, in South Wales, to erect a forge engine that he had built, and when it was done he began the construction of a railroad locomotive, the first ever built. Tramways were in use, and an excellent one near by probably suggested to him the thought of using his steam carriage upon it. It was finished and tried in 1804. It had a wrought-iron cylindrical boiler with internal firebox and round flue that doubled on itself so that the chimney was at the same end as the fire-box. The cylinder was 4¾ inches in diameter, placed horizontal in the end of the boiler. The piston worked in guides and was fastened to a crosshead, from which two long connecting rods went on each side of the boiler to cranks at the rear.

This crankshaft carried a big flywheel, and was geared through intermediates to the four wheels, which had smooth rims. It was used for bringing down iron from the old forge. It worked well, and under 40 pounds steam pressure made 5½ miles an hour with heavy loads. Frequent accidents resulted from the weight breaking the flimsy iron rails, and the engine finally was ditched and later was used as a stationary. This engine was an astonishing success, but, instead of following it up, Trevithick went back to a general engineering practise.

In 1806 we find him entering into a contract to lift up from the bed of the Thames the ballast for all the shipping. This involved huge chain and bucket dredging machines. Two engines were actually built, when he quarreled with the capitalists, and the contract was never sealed. Nevertheless his engine business prospered and he was on the high road to success. But his very success in the Cornwall district seems to have unsettled him.

In 1808 he took out two patents for discharging ships and stowing cargoes by machinery, in 1809 another patent for constructing docks, ships and propelling vessels. This last patent covered the use of wrought-iron plates for naval construction.

While Trevithick was in London he undertook the astonishing task of tunneling the Thames. In five months over 900 feet were dug, when a series of mishaps interfered. Still he persisted until, after 1,100 feet had been completed, he was forced by frequent and serious breaks to give up the undertaking. In the years that followed he took out two or three patents for novel engines and boilers. In one he specified and described our modern screw propeller. His success in the construction of pumping engines brought him to the attention in 1814 of a company engaged in pumping out abandoned silver mines in Peru. A number of his engines were purchased, and he with others went with them to erect and to participate in the enormous profits expected. At first great success was theirs, and Trevithick computed his share as certainly $500,000 a year, when suddenly, in 1818, a revolution ruined the company, and Trevithick with one or two others escaped with their lives to Panama. Here, ragged and penniless, he met Robert Stephenson, who assisted him home to England, which he reached after a serious shipwreck in 1827. He took out two more patents, one in 1831, a method of heating apartments, and the other in 1832, for improvements in the steam engine, the latter including the use of superheated steam. In spite of all that he had done in inventing the locomotive, he took no part in the interesting developments of 1829-1832 with which the name of George Stephenson is associated, and the ultimate triumph of the locomotive. He gave all his thought instead to inventing a steam wagon to run over the highways, and to the perfecting of his steam jet propulsion of steamboats. While thus busied death came in 1833, when he was sixty-two years old. He died with no means and deeply in debt, the workmen contributing enough to bury him, but no stone marks the resting place of this great but vacillating mechanic.

An Expansion Chuck for a Vertical Boring Mill.

BY JOS. M. STABEL.

The drawings show an expansion chuck which has recently been built for use in facing the ends of cylinders on a vertical boring mill. These ends were required to be true with the bore, and as the bore varied it was necessary to have a chuck which would adjust itself to such variations. A commendable feature of this chuck is that its working parts are always free from dirt and chips; in other words, it is a dust-proof expansion chuck. The adjustment of the jaws is done by the four projecting handles *D* which are close

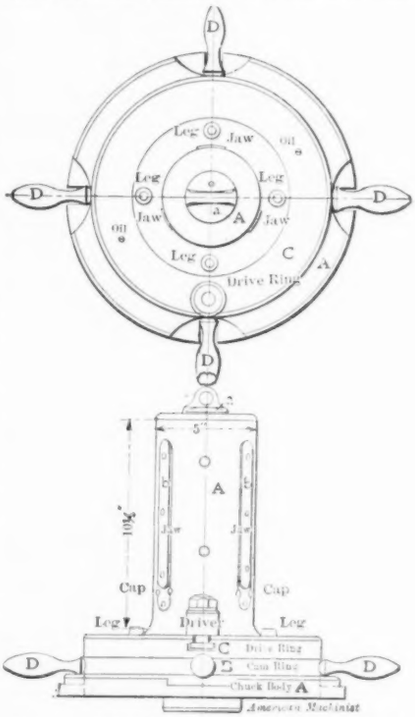


FIG. 1. EXPANSION CHUCK FOR VERTICAL BORING MILL.

to the platen of the machine when the chuck is in use.

The body *A* of the chuck is made of gray-iron, through which there is a 2-inch hole the upper end of which is chambered out to give clearance for the spring which draws in the jaws. This end is also threaded to receive the plug *a*, which in turn has dovetailed into it a piece of steel with a ¾-inch hole through it for lifting the chuck on and off the machine.

There are three vertical elongated slots in the chuck body which are milled with an end mill, leaving semicircular ends to the slots. These slots receive the jaws *b* which are a nice sliding fit. At right angles with the center hole and through the center of the chuck there is a rectangular hole *c* which receives the ⅞-inch square piece of steel *d*, which is hardened and ground. Both ends of this piece bear

on to the inclined surfaces *d* of the steel cam ring *B* into which the handles *D* are secured. This square piece also passes through the square hole in the center piece *E* and is secured there by a ½-inch set-screw. The cam ring has a two-step cam or two inclined surfaces *i*, which surfaces are machined by gearing the lathe as if to cut a 8-10 pitch screw.

The drive ring *C* is made of steel and is threaded to fit on the corresponding thread on the body of the chuck. It is counterbored 5-16 inch. It also has two rectangular notches *e* milled to clear the ends of the 7/8-inch square piece *d*. These notches are marked or located when the ring is screwed "home" on to the body. When the ring is screwed tight down upon the shoulder the cam ring *B* has a running fit between it and the lower part of the chuck body. Into the upper face of the drive ring there is milled a T-slot which receives a stud and collar acting as a driver and engaging a projection on the cylinder to be faced.

At the lower right-hand corner of Fig. 2 is a sketch showing the position of the springs which hold the jaws *b* against the center piece *E*; the tapers on the center piece are such that it will readily release itself. The upper spring, which is a 3-16 inch piece of drill rod formed and tempered, is placed in the notches which are cut into the upper ends of the three jaws. These notches are slightly undercut on the bearing side of the spring so that it will readily stay in position. The other ends of the jaws are held against the center piece by three coil springs which bear against a ¼-inch pin of drill rod set in the end of each jaw. These springs get their backing from the three caps held secure by the three screws.

To assemble this chuck, place the cam ring *B* in position on the body *A*. The center piece *E* is then inserted, and the 7/8-inch square piece *d* is then slid through the elongated hole in the body and through the square hole in the center piece, and secured there by the set-screw in the end of the center piece. The cam ring is then rotated until the ends of the square piece *d* rest at the two lowest points on the cam face *i*. The drive ring is then screwed on to the body, and when it is in position the two square notches that were milled for clearance must be in alinement with the 7/8-inch square piece to allow it to move up and down freely.

The jaws *b* are next to be placed in their respective places, with the four springs which hold them in. The plug on the top is then inserted and the chuck is complete. Of course a small oil hole through the plug and two through the drive ring are necessary to lubricate the cam face, the side of the cam ring and the center piece. To facilitate the locating of this chuck on the face-plate of the machine a boss was turned on under side of the body which would fit a corresponding counterbore in the plate. This chuck was adapted also for cylinders of larger size by having false jaws which were held secure on to the other jaws by three screws through each. When the false jaws are not in use the three screws are screwed into their respective holes, which are counterbored to receive the head, thus not allowing them to become filled with dirt and chips.

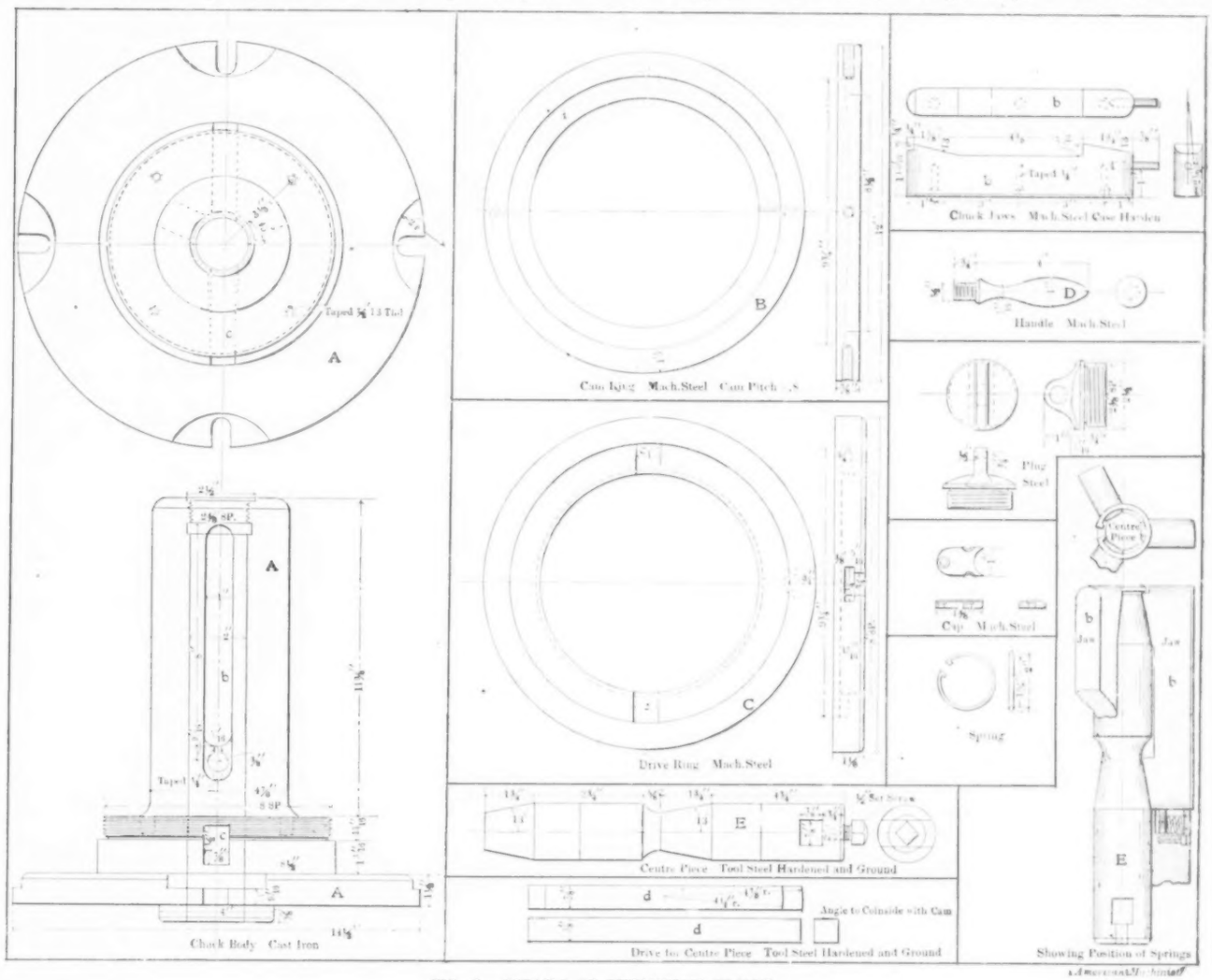


FIG. 2. DETAILS OF EXPANSION CHUCK.

Miss Utaplace—Allow me to introduce you to my perspective husband.

Miss Parcavenue—You mean your "prospective husband," don't you?

Miss Utaplace—I mean exactly what I say. He's a draftsman.—*Baltimore American.*

Letters From Practical Men.

A Boring and Facing Fixture.

Editor American Machinist:

It often seems as if the originator of a machine wilfully tries to make the tool designer show the white feather when the latter is handed drawings of difficult parts, for which he must construct tools and fixtures, altho being reminded that such tools must deliver the work in a most accurate, interchangeable and inexpensive way.

The accompanying illustrations show a fixture for holding and indexing a rather difficult piece of work. Altho the shape of this piece of work is not the worst to be encountered, it nevertheless is worthy of notice, as there are six different bores and one facing operation to be made at one setting. It is necessary to accomplish all these at one setting, because the casting (which is of gray iron) has no previously finished surfaces to work from, and all these bores and facing must be accurate in relation with one another.

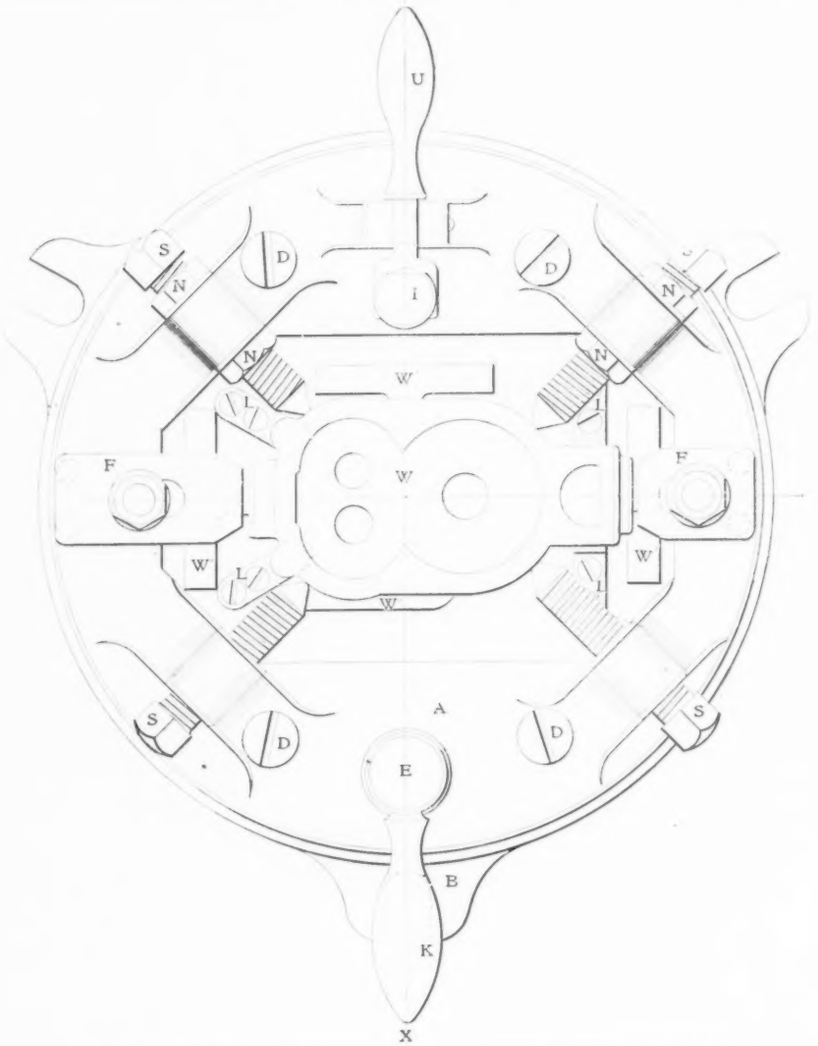
Fig. 1 shows the plan and side elevation of fixture with the piece of work (marked *W*) in position. The detail description of the piece of work is not very clearly shown, so it may be well to mention that there are four projections on the under side of the same which project a little beyond the main body and to a depth ranging from 1¼ to 1¾ inches below the body, these projections being marked *W*. The main body rests on the four legs *L L L L*. No doubt three legs on this unfinished surface would have been superior to four, but positions of projections would not allow this.

The work is located in position by the four screws *S S S S*; after getting the proper location two of the screws are locked in position by the four lock-nuts *N N N N*, the other two screws being used when changing work. The two finger straps *F F* at each end serve to hold work secure against the legs. These straps have an elongated hole which allows them to be readily withdrawn from the work, they in turn being held from dropping down by the coil spring *C*, seen in Fig. 2.

One end of each strap rests on two studs which are fast in the body of the fixture. The holes to be located and bored can readily be seen in the plan view; each of the three large bores are 1¼ inches in depth and 2½ and 1¾ inches in diameter. Concentric with these holes are three smaller holes which are bored at the same setting; all these bores must be accurate both in size and center distance.

A very good idea of the construction of this fixture can be had from Fig. 2, it being a cross-sectional view through the part marked *X X* in Fig. 1. The base-plate *B* is made of gray iron and is nothing more than a ring with three lugs upon it for clamping it down; this ring has a T-slot turned in it, into which the binding bolt *C* and the four shoulder screws marked *D D D D* (seen in Fig. 1) travel.

These four screws are screwed and shouldered against a small segment plate, which in turn is a running fit in T-slot, this holding the main body *A* to a nice running fit on *B*. The locking bolt *E* also fits into the T-slot and serves to hold *A*



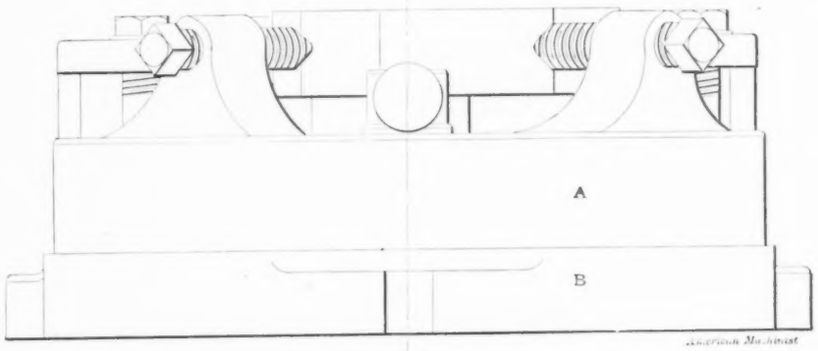


FIG. 1.

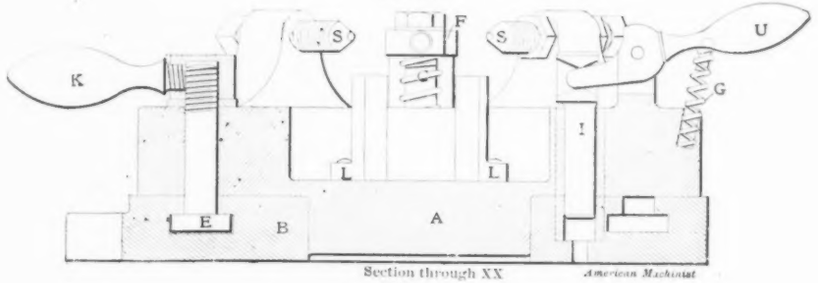


FIG. 2.

A BORING AND FACING FIXTURE.

and *B* secure while accomplishing the boring.

The indexing for the three different positions is done with accuracy by using the index plug *I*, which is hardened, ground and lapped and fits into a hardened and lapped bushing, which in turn is pressed into *A*; three similar size bushings are located in the base ring *B*. The lever handle *U*, which has its fulcrum in the lug cast solid with part *A*, serves to raise the index-pin out of the lower bushing and also acts as a handle for revolving part *A* around to the next bushed hole in *B*. The spring *G* always gives the index-pin a downward pressure.

The most difficult part encountered throughout the making of this fixture was the locating of the three bushing holes in the base ring, as they necessarily had to be very accurate. This was accomplished by figuring out the angles and distances that coincide with center distances on work; after having these figured, it was but a small item to locate buttons on the work, indicate them upon the lathe, and bore holes. The manipulation of the jig no doubt is readily understood by loosening the handle *K* and then pressing down the handle *U* which disengages the index-pin, at the same time using the same handle to revolve the jig to the next bushed hole in *B*. This fixture can be used on lathe or vertical mill. JOS. M. STABEL.

A Special Automatic Milling Fixture.

Editor American Machinist:

It was required to mill circular bottoms at different intervals in a slot and with various angles. Formerly an independent fixture was used for holding each piece of work to be milled and one person had to attend to each operation continuously. Now, with six to eight different styles of automatic attachments an unlimited variety of work can be accomplished, and but one person will be required to attend to them all. This fixture was designed to meet those conditions. There are three different pieces of work to be milled with but a slight variation in their shapes. The first piece has a ½-inch slot through its entire length, and one circular cut down in the bottom in the center of the piece. In the second there is a .375-inch slot and two circular cuts in the bottom, one near each end. This piece has been beveled outside on each side to 7 degrees from the right angle. The third has a .300-inch slot and three circular cuts at the bottom, one in the center and one at each end, with a 10-degree angle on the sides. All these cuts were accomplished with one fixture, with special pattern formers for each piece of work.

The attachment is placed upon the platen of the milling machine to which it is firmly clamped by means of six screws *b*. On each side of the milling machine two screws are taken out, and the formers *a* are placed on top of the gibs and clamped with two longer screws *c*. These formers are made of mild steel and case-hardened. On each side of the fixture are screwed into a shoulder two stud screws with hardened rollers *d*. These rollers ride freely on top of the formers and raise the milling fixture to the desired hight while the circular depressions in the piece of work are cut. When the fixture is in the lower position the cut is parallel with the platen. At each end of the fixture there is a U-shaped piece *e* fastened to the platen with three screws and two dowel pins, the left-hand piece acting as a vertical guide for the end of *m*, while the other end of *m* is pivoted on the pin *f*.

On the top of the fixture is placed the vise, made in two parts. The front *g* is held securely by three screws and two dowel pins. The rear part *r* moves freely and is held down in position by two T-screws *h*. The face of each jaw is bored to a circular seat and in these fit the adjustable jaws, held in position by two screws *l*; these provide the adjustment for different angles of the work to be milled. The shaft *p* is made of tool steel, and has the cams *o o* integral with it; these have a ¼-inch throw. The coil springs *j* are for withdrawing the jaws and releasing the work after the cams are thrown back. A. L. MONRAD.

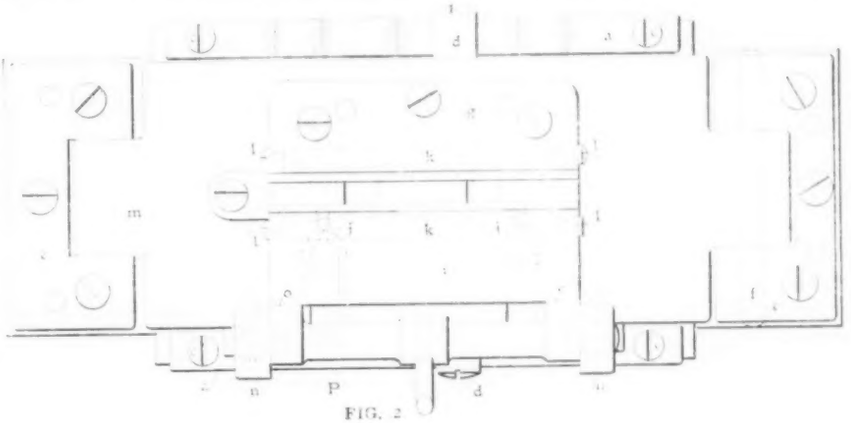


FIG. 2

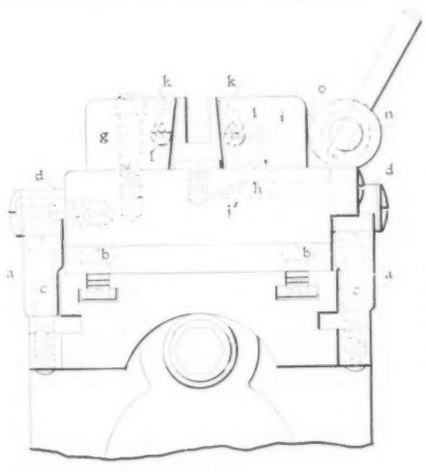


FIG. 1

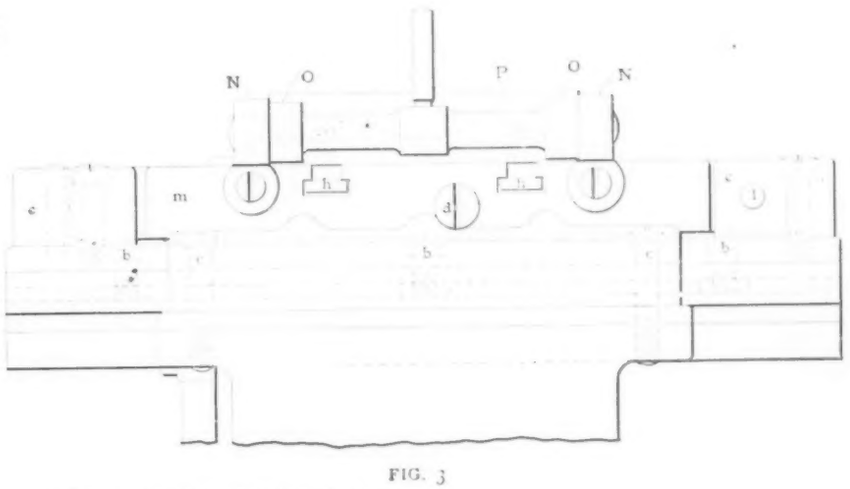


FIG. 3

A SPECIAL AUTOMATIC MILLING FIXTURE.

A Center Cleaner—Lathe Tool Holder.

Editor American Machinist:

The accompanying drawings show three very useful tools. Fig. 1 is a center cleaner which is made of tool steel, about 3½ inches long. The handle is knurled and is about 5-16 inch diameter. The end *a*, which is turned to an angle of 60 degrees, is split with a very fine saw and then sprung together, and hardened and spring tempered. By inserting in the slot a piece of cotton cloth about ¾ inch square, you have a center cleaner that is always ready and will save you a good deal of time looking for a rag or a piece of waste; I

have worked in shops where waste was as rare as gold nuggets.

Fig. 2 represents a forming tool-holder that is very handy also for V- and square-thread tools like those shown. The tools that it holds are ⅜x½ inch. The body is of tool steel 1x1½-inch cut down ¼ inch at the front end.

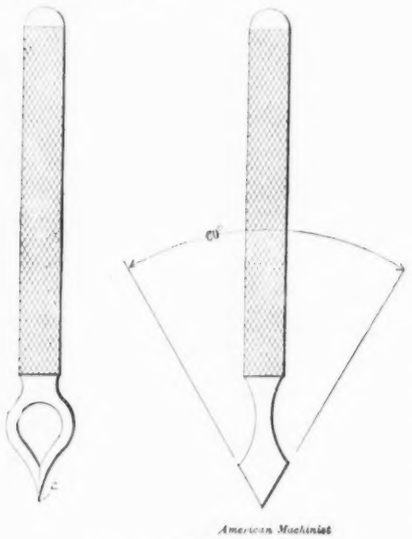


FIG. 1. CENTER CLEANER.

The head *b* is of tool steel, the top being knurled; the slot is ½x1¼ inch. The shoe *c* is ⅛ inch thick and slightly cleared at the center to insure its bearing properly at the ends. It overhangs at each end to prevent it from falling out, and is put in place before the tool-holder is assembled. The screw *d* is ⅜—16, and the pin *e* ¼ inch in diameter.

In Fig. 3, *f* is an end view of the body of a tool-holder for holding round boring and threading tools. It has a V on each side, one larger than the other, for different sizes of tools. The V in shoe *g* is relieved slightly at the center, and the ends overhang the same as shoe *c*. The same head is used as with the tool shown in Fig. 2. The pin *e* is so located that the head will swing around to either side of the holder. This pin is a drive fit in the body and a running fit in the head.

OREL B. FRENCH.

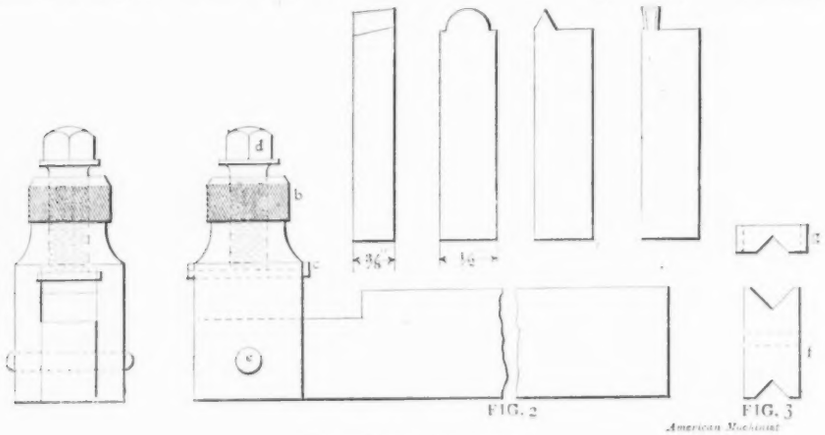


FIG. 2 FIG. 3

TOOL-HOLDER AND TOOLS.

Adjustable Die and Automatic Die Holder.

Editor American Machinist:

I am sending you sketches of two simple but useful tools. Fig. 1 shows an inserted cutter, adjustable die, which is very inexpensive. The blades are inserted in the same way as in any other die. The body *a* has four dovetail slots in it at an angle of about 5 degrees, the cutting edges being radial. After the dovetailed slots are cut in, the body is split as shown and the adjusting screw is put in. When this die is used in its holder the set-screws of the holder will supply the external pressure to lock the die firmly together, and in making the holder for this die there should be a hole drilled to get at the screw for adjusting the die without taking it out of the holder. For very large dies two adjusting screws should be used, locating each near one of the sides.

The only thing that may be difficult to one who has never made one of these dies is the drilling and counterboring of the hole for the adjusting screw. If there are a large number of dies to make, a very inexpensive jig can of course be made to do it in, but if there are only a few it can be done in the miller or the lathe by strapping the die body to the slide rest or the miller platen and using a two-lipped milling cutter of the desired size. The counterbore can thus, by careful feeding, be cut without much trouble, and the drilling is then done while the die body is still strapped down, catching the drill in the chuck. If the die body has been split before drilling for the adjusting screw, a sheet-steel shim should be placed in the slot.

Fig. 2 shows a handy die-holder. It is easy to make, as there are but two parts to it, besides the screws. The shank is turned to fit in the turret, and the clutching and releasing mechanism is contained in the front part of the device. Two stop-pins *a* are used for releasing, one driven into the die-holder *A* and the other into the body *B*. The forward part of the body is larger than the shank, and is grooved at *c* to receive the end of the backing screw *b*, which in the design shown is a filister head screw firmly screwed into the die-holder. The forward side of the groove *c* is helical and serves to guide the point of screw *b*, which acts as a backing pin into its place at *i*. The die-holder *A* is a good sliding fit on the body *B*.

In the position shown the clutching pins *a* are disengaged, and the die-holder *A* is free to rotate about the body *B*. If

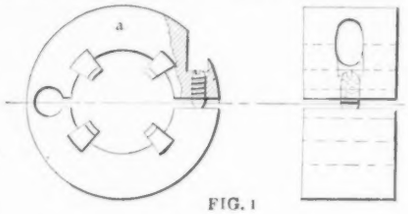


FIG. 1

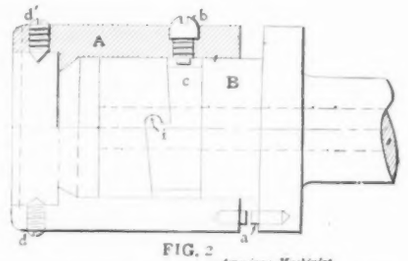


FIG. 2

ADJUSTABLE DIE AND AUTOMATIC DIE-HOLDER.

now the turret is withdrawn while the work just threaded is rotating in the reverse direction, the backing screw *b* is guided into the notch *i*, clutching the body *B*, and the die is unscrewed from the work. The body *B* with its shank has a hole drilled through it, so that quite long pieces can be threaded.

In making such a holder, care should be taken to locate the backing screw and the grooves so that the groove will not be uncovered by the advance of *A* when the backing pin clutches the body. If the die-holder is to be used for a right-handed die, the helical side of the groove must be right-handed, as shown in Fig. 2, and for a left-handed die it must be left-handed.

This holder can be made for both right and left threads. To do this the body *B* and the holder *A* are made long enough to receive two grooves, the front side of one being made with a right-hand helix, and the front side of the other left-handed. A hole for the backing pin is drilled and tapped for each groove, and the screw *b* can be changed from one to the other. A blank screw should be provided to fill the hole not in use.

D. HOLDER.

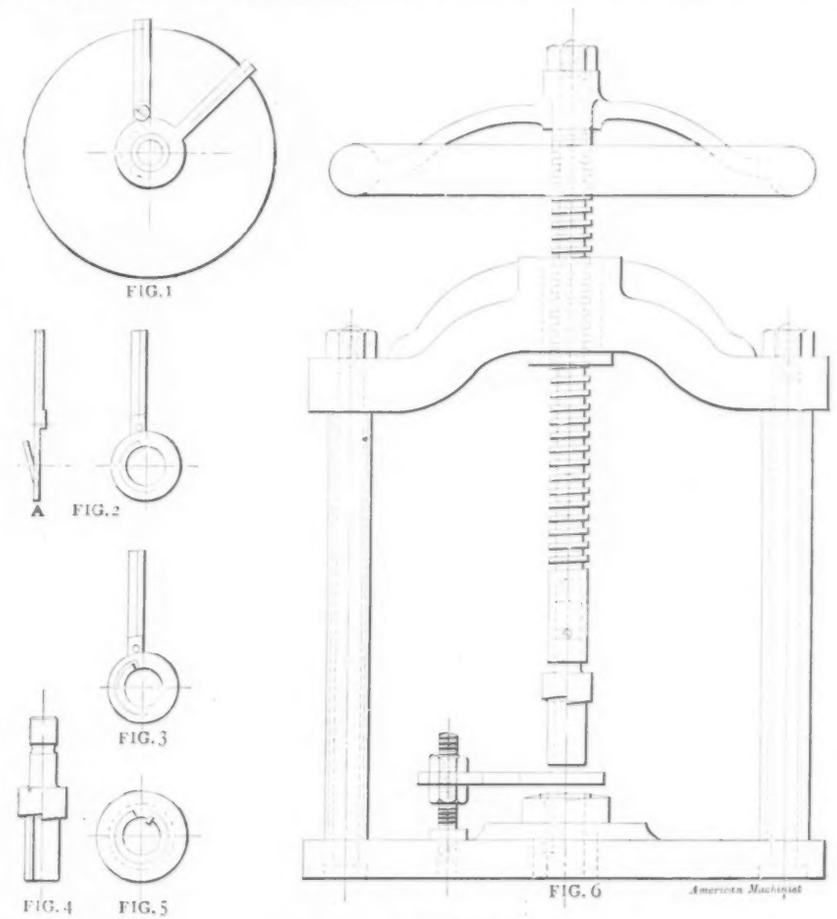
A Shearing-Punching Operation.

Editor American Machinist:

This is to tell how a punch and die were made for punching the spring on the index fingers of dividing heads of milling machines. These fingers are made of bronze and the old way was to cut the spring on a scroll saw, which required a number of saw blades and patience, also time: with the punch they are easily and rapidly done. Fig 1 shows an index plate

and fingers, dotted line showing the spring to be punched. Fig. 2 shows a finger punched. *A*, Fig. 2, shows the position of the spring after being punched in the finger; the outer edge of the spring is then relieved with a file and pressed back. Fig. 3 shows the job finished. Fig. 4 shows the punch, which has a leader for guiding through the index finger. The guide has a spline which fits a key in the die, Fig. 5. This brings the two shearing edges in line. Punch and die have a circular shearing cut, and by varying the depth punched the spring may be made any length to suit. The punch was made by setting the lathe at 3 to the inch and threading to a stop, which was a hole drilled in the punch and chipped out to a cutting edge. The die, Fig. 5, was made in the same way, and both were then hardened. Fig. 6 shows the arbor press on which the job of punching is done.

W. R.



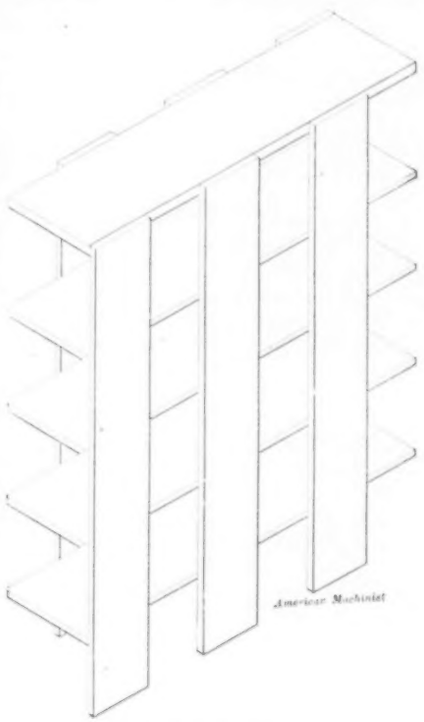
A SHEARING PUNCHING OPERATION.

Sectional Shelving.

Editor American Machinist:

The sketch shows the essential feature of a system of shelving originally designed for the storage of files, but subsequently extended until it is now used in various sizes in the toolroom and for the storage of small articles in both stores and stock room. In a modified form it is also used by the office staff for forms and office supplies. It is designed on the principle of sectional bookcases and filing cabinets, and has been found to possess similar advantages in the shops as for office use, chief among which is probably the ability to increase the special space required for any particular purpose, and to insert such additional space in its proper relative position; instead, however, of starting from the ground and building up as additional space is required, the sections or units are vertical and placed side by side. As originally designed each section was about 4 feet high and 20 inches from front to back, the width of the shelves varying from 4 to 11 inches, the latter being thought the limit to which it was advisable to depend on shelves made of 1-inch stuff and supported only by nails driven into the sides. When these sections are placed side by side the uprights of one section fit into the spaces of the other, thus forming a closed partition for each section. The sections may be fastened together by cleats front and back, leaving a flat table on top, and upright pieces may be placed in the outer sides of the end sections to fill the spaces.

In the greater number of instances in which this shelving is at present used the sections are accessible from both sides, and in those first built, which were for the storage of files, all the spaces were divided into two, varying in depth from 4 and 15 inches to 9 and 10 inches, files of different kinds being on the two sides of the shelving, and occupying only the space necessary for each size; thus a certain kind of file was allowed space increasing from 4 to 18 inches counting from the floor up.



SECTIONAL SHELVING.

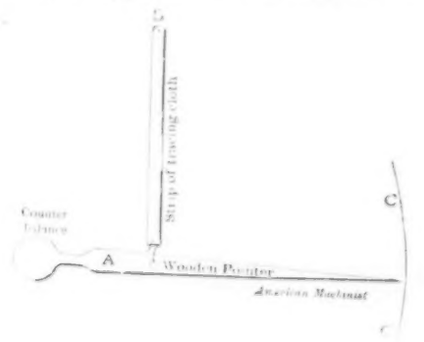
In the corresponding spaces on the other side of the section were kept files of a different kind arranged according to size from the top down. When the space used for the storage of any particular article is found insufficient the cleats are unscrewed, one part of the shelving is moved along and another section is inserted where required.

KENNETH FALCONER.

A Cheap Hydrometer.

Editor American Machinist:

The line cut shows a cheap and fairly accurate hydrometer. The back of the instrument is a board and can be made any size. The balanced wooden or aluminum needle (made as light as possible) is pivoted on the board at *A*. One end of the strip of tracing cloth is fastened to the



A CHEAP HYDROMETER.

board at *B*, and the other end is connected with the indicating needle by means of a small wire hook. The segment *C C* is laid off on the board. When completed the instrument is hung with the strip of tracing cloth vertical, *B* of course being at the top. The instrument is then ready for calibrating, which can be done in accordance with the humidity reports in the daily papers. The hydrometer will record with fair accuracy for quite a long time.

DIXIE.

A Boring Head.

Editor American Machinist:

I have in times gone by bored very many steam and water cylinders, as well as superintended the boring of many more. When the time came when I had something more to think about than getting in so many hours per day at so much per hour, I naturally wanted to get as much work from the machines and tools as I could, and produced a line of boring heads as per sketches furnished you, commencing with boring heads 8 inches in diameter up to and including 26½ inches diameter. The combination of boring heads was somewhat expensive, but I am of the opinion that first cost is not to be considered when quality and quantity justify the outlay. The sizes of cylinders increased by 2 inches, as 8, 10, 12 and so on up to and including 26 inches. The water cylinders must be bored larger to admit of brass lining—for instance, a 14-inch water or air cylinder must be bored 14½ inches.

The boring heads from 14 inches advancing by 2 inches were made as per sketch, the boring head being of gray iron, and plenty of it; six tool-holder openings were machined into head, as per Figs. 1 and 2. The tool-holders were made of machinery steel, filed and scraped to proper bearing. The tools (high-speed steel) were held into the tool-holders by clamp and cap bolts large enough to insure rigidity. Each tool-holder was held back by an eccentric shaft having on its back or outer end a clamping nut *C*, as shown in Figs. 2 and 3. It will be noticed that eccentric shaft has a collar next to tools; this collar receives the strain when shaft is locked. It will also be noticed that the eccentric shoulder is enough short to allow shaft to be locked by nut *C*. The collar is also large enough in diameter to prevent any chips or dirt entering the elongated hole in the tool-holder into which eccentric enters. The eccentric, as shown, is in the position to make a 20-inch boring head, but "Ed" may get an order from the foremen to next bore a 20-inch water or air cylinder; this means that he must have a head suitable for 20½ inches bore. This is quickly furnished him; he releases lock-nut *C* and turns the eccentric to the right one-half turn or until the eccentric has made its full travel and come to stop at the end of elongated hole (he cannot turn eccentric further) tightening nut *C*. Each tool is treated the same way and the entire operation is of but a moment's duration. He now has as perfect a 20½-inch boring head as it was a moment ago a perfect 20-inch boring head. The eccentrics of course can be made for any throw desired within a reasonable limit.

After the roughing cut has been through the cylinder, the finishing tool is placed in position as shown in Figs. 1 and 2. It will be noticed that the finishing tool is at the back of the head and will make the cylinder to size, allowing the roughing tools to turn into the clearance space made by the finishing tool. The speed of the machine bar and head is decreased one-third during finishing cut, but the feed is quadrupled and also reversed. The finishing cut is taken by a pull on the boring bar instead of a push, as is the case when roughing cut is taken. I think your readers can see that after the finishing tool is once set to size, there is but little measuring to do except when the tool has been sharpened. Adjusting screws are provided under each tool for wear compensation. The casting is also cut away at set-screw heads, to allow the free use of open-end wrench. The finishing tool adjusting screw has lock-nut, as this tool must be removed after finishing cut and before a start is made upon another cylinder. The roughing tools are not changed by machine operator except with eccentric.

Each sized boring head is supplied with finishing as well as counterbore tools, and the counterbore tool is expected to be correct as to length, etc., so as to produce cylinder counterbore of exact size when used in boring head in place of finishing tool. Size of boring head is marked upon each finishing and counterbore tool and these tools are retained by the operator.

Those of your readers who are familiar with cylinder boring will understand that a finishing tool ground correctly as to clearance for a 20-inch cylinder would not have the necessary clearance for, say, a 14-inch boring head and cylinder. The exact reverse would be the case; should a 14-inch boring head and cylinder finishing tool be used in a 20-inch head when boring a 20-inch cylinder, too much clearance and also chatter. All boring heads smaller than 14 inches are made for smaller boring bars and each size cylinder has its own head.

All heads were made interchangeable for most machines throughout the shop. In some instances we made new boring bars; in others we made bushes to suit the smaller bars and the boring heads having the larger holes. An old lathe out of commission was used for a grinding machine, and a handy man was educated to properly grind boring heads and also milling cutters. This always insured sharp tools and placed the responsibility, should a boring head not work properly on account of imperfect grinding.

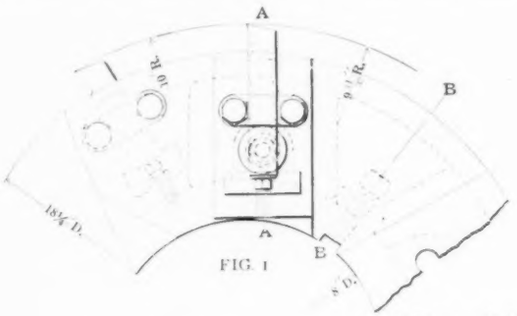


FIG. 1

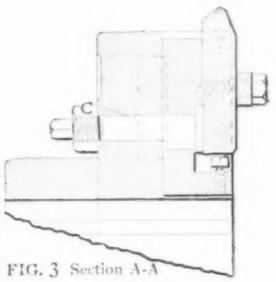


FIG. 3 Section A-A

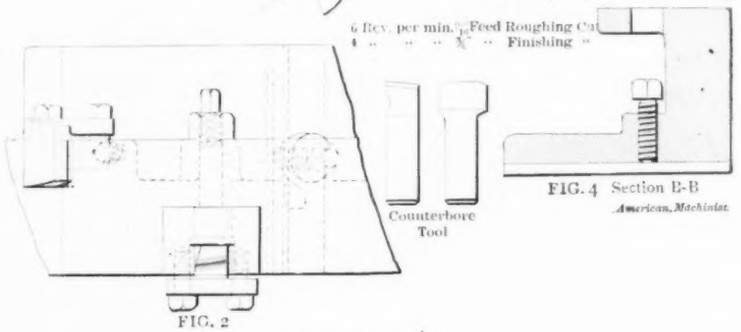


FIG. 4 Section B-B

FIG. 2

A BORING HEAD.

Fig. 2 is a top view of head; Fig. 3 is a section at *A A*; Fig. 4 is a section at *B B*. One space cored under rim of head, as at *B B*, was cast solid so as to provide for finishing tool. Each boring head was plainly marked with the speed at which it should revolve as well as the feed to carry, thus: "Six revolutions per minute, 3-16 inch feed, roughing cut; four revolutions per minute, ¾ inch feed, finishing cut." This allows the machine operator no discretion whatever, and in case he gets a hard casting, the fact is reported to his foreman, who uses his judgment as to whether the speed and feed should be cut down. It also gives the contract clerk data from which to make his estimates when making up contracts. There is no use in disguising the fact that improved tools have the tendency to replace first-class men with help not so expensive, and

although I have made many such tools, I am not blind to the fact that the handy man's field is being extended and the skilled man is restricted by their use.

The 12-inch special boring head, Figs. 5 and 6, is used upon one job only, boring the crosshead guides of a Corliss type air compressor. The company had many to make, and of course wanted to cut the manufacturing cost wherever possible. The time consumed in the boring of a frame crosshead guide under the old way of operation was about twelve hours. I have known of five frames being bored in fourteen hours, using this 12-inch special boring head. The speed at which the head was to revolve, as well as the feed to use was plainly marked upon head, and the machine operator was expected to obey the instructions. Any of your readers can easily figure out how long it would take to bore crosshead guides, 32 inches long, when using a speed of 10 revolutions per minute and ⅛ inch feed per revolution. You will perhaps notice I make no mention of the facing of the ends of cylinders or bed. This facing was expected to be done during the boring process, and I always counted upon getting this "done for nothing." The roughing tools were placed one upon the other, the outer tools cutting a less diameter than the inner tools. The feed being ⅛ inch per revolution made the amount of feed for each pair of roughing tools 1-16 inch. The distances between roughing and finishing tool on cord line was greater than width of guide; this allows the roughing tool to leave the work before the finishing tool enters.

Roughing and finishing tools are not both in contact with casting at the same time, and the same results are obtained as though an extra cut for finishing had been taken as when using an ordinary boring head. Fig. 1 shows section of crosshead guides. The boring head was made fast to the bar with set-screw and key, Fig. 1. I had some trouble to get the boring head used as I desired by some stubborn machine operators, but after a few examples had been made, trouble ceased. I have made note of the fact that when a workman, especially an old hand, made conditions uncomfortable for me, inquiries usually revealed to me that he belonged to the same lodge as the superintendent.

BECK.

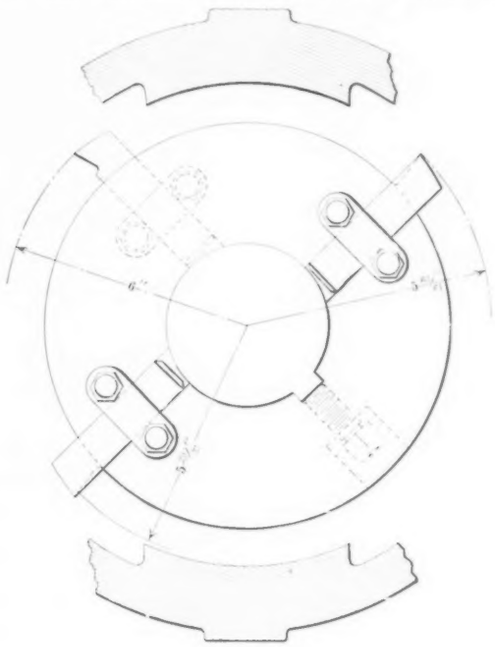


FIG. 5

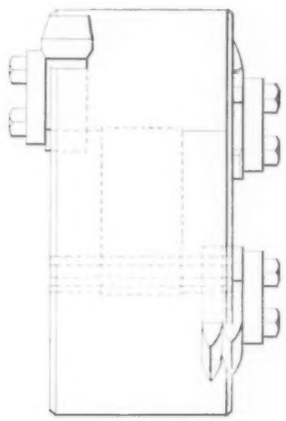


FIG. 6

A BORING HEAD.

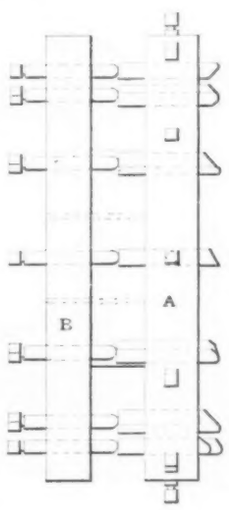
An Inserted Tooth Facing Cutter.

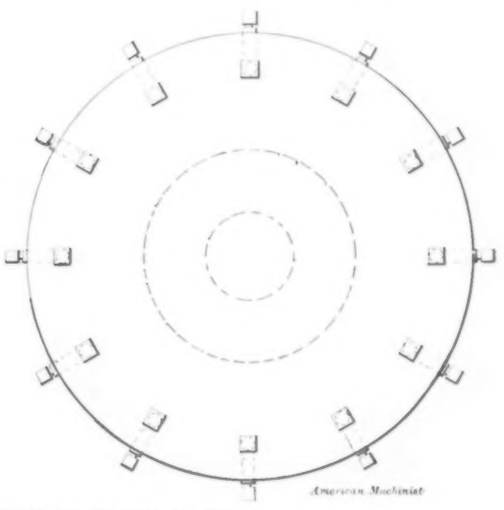
Editor American Machinist:

The accompanying cut shows a home-made facing mill which is inexpensive to make and can be put to a great variety of uses. It was made to fulfill the need for a facing tool for the bottoms of grinder heads, drill presses, lathe legs, etc., and tool money being scarce the design here shown was hit upon as being economical and giving the desired result.

A is a plate of cast iron about 1½ inches thick and 12½ inches in diameter, in which are cored sixteen holes for ½-inch square tools. *B* is another plate of cast iron 1¼ inches thick and of the same diameter as *A* into which are put screws for backing up the tools. The body of the mill is threaded at the back so as to screw upon the spindle. By using high-speed steel for the cutters, and grinding them as shown a very efficient and durable mill of large size is obtained. Very little care is necessary to keep it in working order.

L. A. M.





INSERTED TOOTH FACING CUTTER.

A Belt Lacing Scheme.

Editor American Machinist:

I have recently adopted in the shop a new feature which proves to be a time-saver, and may interest some of your readers. It is in connection with the Jackson spiral wire belt-lacing machine used in many shops. I refer to the machine which requires a piece of rawhide about 3-32 inch diameter inserted to complete the lacing and forms a hinge pin.*

Instead of cutting a belt the right length to reach around pulleys and allowing for proper initial tension, a new two-ply belt, say, 20 feet long by 4 inches wide, is cut 7½ inches shorter and an extra piece 5 inches long is inserted to make up the deficiency and provide for tension. The belt man has several sets of pieces of 4-inch belt in lengths of 1, 2, 3, 4 and 5 inches, with wire lacing in their ends ready for use. After the new belt has been run a few hours and requires tightening, he takes the two rawhide pins out, removes the 5-inch piece and inserts a 4-inch piece, repeating the operation at intervals when occasion demands; using the 3-, 2- and 1-inch pieces until the two ends of the belt come together. We have a belt that has been taken up five times and has been

*This machine is made by the Diamond Drill & Machine Company, Birdsboro, Pa.—ED.

laced only once; the five pieces are carefully saved for future use in a similar case.

To determine the length of a new double belt, a tape line is drawn around the two pulleys in the manner the belt would be when working; ⅛ inch per foot is deducted from the length obtained to give tension to start with; then ¼ inch per foot is deducted to allow for the final elongation, which will in time permit the ends to come together.

In the small shop where a man is not regularly employed on belts, the several sets of different width belting can be placed in the toolroom, and the machine operator can at any time exchange a long piece for a shorter one and thus save the time of relacing. It is possible with a little care to fasten the ends of wire lacing so that they will not wear or tear loose.

C. H. B.

Grooving Tool for Firebox Steel Plate.

Editor American Machinist:

The illustration shows a tool which was used to cut the grooves as shown at Fig 1. The work consisted of four feed water heater heads of firebox steel, each head containing 450 ⅞-inch holes. The tool is held in a drill press by a Graham chuck and dropped into the holes until it rests on the shoulder *S*. The drill press being started, the operator holds the handle *H* until the cutter *C* strikes the pin *P*. The machine is then stopped until the sleeve *M* is unscrewed to its lower position by hand, after which the tool is removed from the hole, when it is again ready for the next. The average time required to cut the first 450 grooves was three-quarters of a minute each, there being required an operator and a boy, the latter's duty being to start and stop the machine.

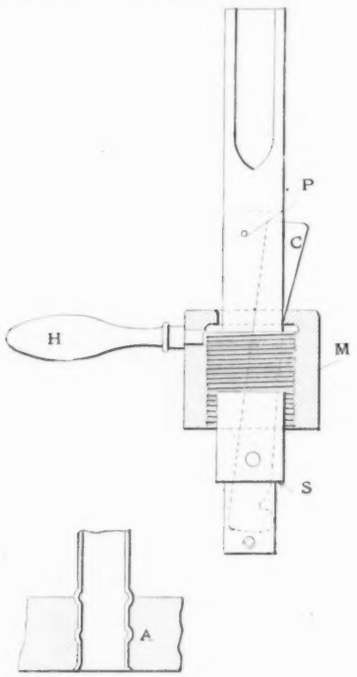


FIG. 1

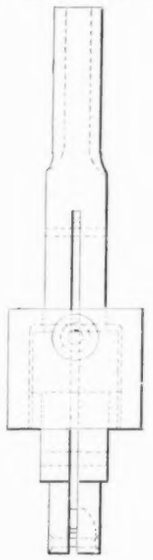


FIG. 2

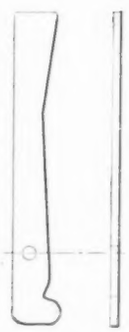


FIG. 3

American Machinist

GROOVING TOOL FOR FIREBOX STEEL PLATE.

The ⅞-inch holes were drilled with a high-speed steel twist drill running at 240 revolutions per minute. The average time for drilling each hole was 0.70 minute.

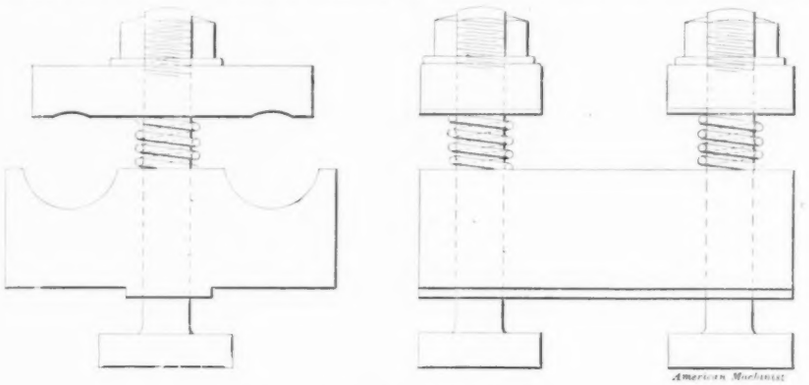
M. F. G.

A Boring Tool Holder.

Editor American Machinist:

The sketch shows a simple and handy tool-block for the lathe, which is fastened to the slide-rest by the two bolts which also clamp the bars which hold the cutting tools. The circular grooves are of a bore equal to the size of the bars. This block can be used with either one or two bars, and is quite a convenience when rough boring or finishing holes in different kinds of work. For turning packing rings this fixture can be used to good advantage, as the boring and turning may be done simultaneously, when the size of the packing rings will admit of it. It is preferable to have the boring tool to cut upside down while the opposite bar is doing the turning, as per Fig. 2. This equalizing of the strain on the lathe gives better results than when tools are used in the regular way.

A. L. M.



American Machinist

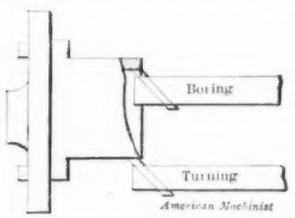
FIG. 1. A BORING TOOL HOLDER.

Mechanics as Machinery Salesmen.

Editor American Machinist:

At page 165 I made some remarks about machinery salesmen, suggesting that it would probably be better to get some of our salesmen from the shop instead of from the office. At page 467 I note that Mr. Springer seems to take an entirely different view, but in a great measure he really verifies what I contend.

Mr. Springer says that a machinist who is practically master of his trade will make a failure as a salesman. I have had the pleasure of meeting several of the salesmen of one of the largest and most reputable tool concerns in this country, and all of those men came from the ranks, have been on the road a number of years to my knowledge, and cannot be called failures. I agree with Mr. Springer in that there is not one mechanic in a hundred who has enough business experience



American Machinist

FIG. 2. USE OF THE TOOL HOLDER.

to start out and sell goods, and for this reason I advocate taking him into the office and giving him some. A mechanic won't develop commercial instinct or business ability at the lathe, the planer or the vise. Mr. Springer says shop men are so full of conceit and mechanism that there is no space left for business ideas; yet he goes on to tell us about a man who has no equal as a mechanic or a salesman.

I can understand how a stenographer can rise to be secretary of a concern without having much mechanical knowledge. Mr. Springer tells of a man, "known in every city, town and hamlet," who left the shop and assumed the rôle of salesman, "and it did not take him long to

catch on. He never allowed a contract to slip by him," and Mr. Springer never knew a better salesman. To-day this man is president of the concern for which he sold tools; yet this man came from the shop.

Mr. Springer's position reminds me of the man who looked into his cup and addressed the waiter as follows: "If it's coffee bring me some tea, and if it's tea I want some coffee."

That Yale man who was continually hurting the feelings of his customers by condemning their equipment is not, in my judgment, the kind of a salesman a mechanic makes. The most ordinary tact should prompt a salesman to avoid doing this, and tact isn't usually learned at college. It is sometimes necessary to tell a prospective customer what he really needs, and for that reason it is well to be even better posted than he.

Mr. Springer concludes his article with the story of the boy who sold the belt with a hole in it and convinced the superintendent that the hole was put there for a purpose and got promoted for it. I think the manager who promoted him had a hole in his conscience larger than the one in the belt, and that he would have done better to have come out frankly, acknowledged an inferior job and made it right.

Here is another little instance which still makes me feel the need of salesmen with mechanical ability. We wanted a small motor for driving a machine and called up the manager of a large electrical house to send a man around who could tell us what kind of machine was best suited for this particular place. In due time a young man appeared to look at the machine, and, as I supposed, to tell us our needs. This young man lit a fresh cigarette, wrinkled his brow and proceeded to use business ability, or commercial instinct, or whatever you call it, to get me to say what to furnish. This I refused to do, because I did not know what was best for the purpose. Luckily I knew what I wanted to accomplish, although I didn't know the best electrical means of doing it, so I insisted that they should furnish us their best means of driving, explaining how it was to be attached, etc. Result: We have been called up several times for information. The motor finally arrived, and the rheostat was so large that it could not be applied to the machine. The rheostat was returned, and we are now awaiting a smaller one which is "more suitable for our particular case, and which can be readily had." I still believe that a salesman should know his line, and the one just referred to could easily carry a little mechanical knowledge without overtaxing himself and driving out the business ability.

ART ISAN.

Two Spring Collets for the Miller or the Lathe.

Editor American Machinist:

The surprising demand for spring collets for use in machines not specially designed for them seems to be growing larger every year, and appears to have been largely overlooked by the milling machine and lathe makers. Fig. 1 shows a design of collet which has given entire satisfaction for several years in holding small mills in a hand-milling machine and which is equally applicable to lathe work.

It will be noticed that the front end of the collet is straight, and while it has proven entirely satisfactory, the design shown in Fig. 2 is recommended to the more critical (who are willing to pay the extra expense) for the reason that it gives an equal pinch on the work per unit of length.

CHARLES H. MCCLELLAN.

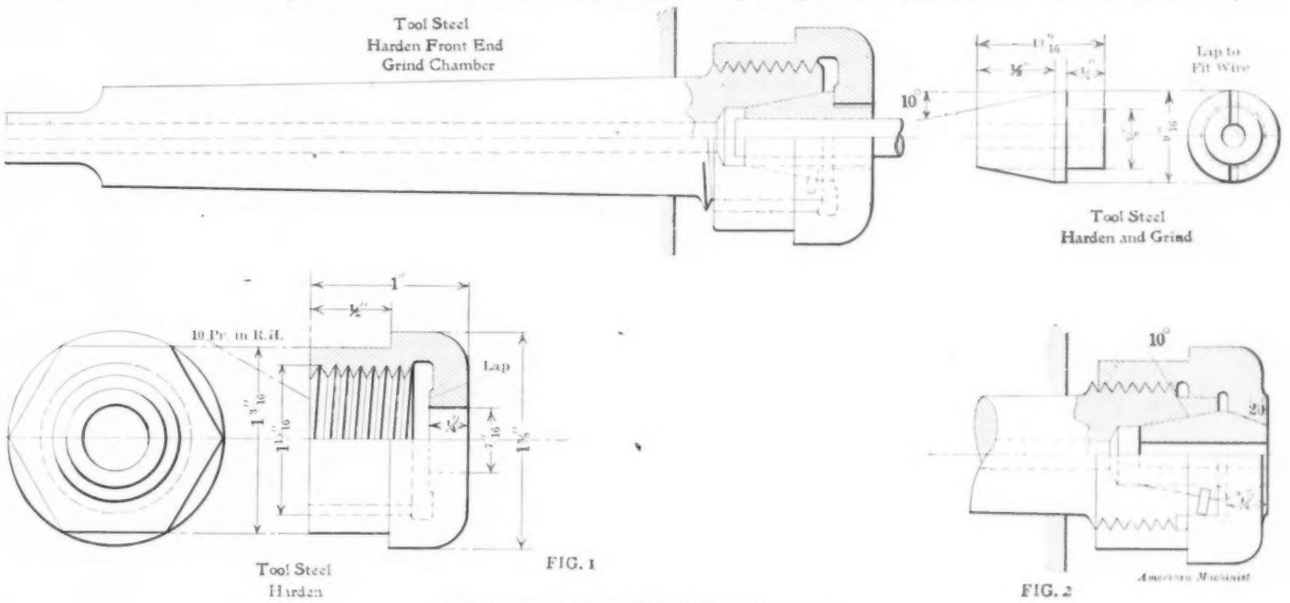


FIG. 1

FIG. 2

SPRING COLLETS FOR THE MILLER OR LATHE.

Getting Ahead of a Swindler

Editor American Machinist:

Things had gone fairly well in the shop; we had only one job on hand that looked at all like a loss—a lot of drill jigs. We had been paid for the metal patterns for the machine itself and they had been delivered. But Mr. Jones seemed very anxious to get the jigs out of our hands without paying for them. Two or three months had passed, as had also several letters between Mr. Jones and the firm, but with no tangible result in the way of cash. One afternoon, while out on other business, I met Mr. Jones. He was dressed as usual—plug hat, flowered waistcoat (vest would not carry my meaning), gloves. "How are you, Mr. Jones?" "Why, how are you, Mr. Dixie? I'm awfully sorry I can't settle that little bill of yours. You see, I dropped quite a lot in Northern Pacifics." "Don't let our bill worry you, Mr. Jones; we are not losing any sleep over it. You've got some castings, I believe; what's the matter with your shipping them over to the shop. We'll put the castings together for you, and then you know you can sell them and we'll get our money." "My dear Mr. Dixie [I was his "dear" now], if you will do that for me I'll ship the castings at once; there's 100 sets; let me see, how much will you charge me for putting the castings together?" "Not one cent, Mr. Jones; we have always stood by our patrons and we don't intend to leave you in the lurch; all we expect is that you will use every effort to get enough money together to pay our bill; in the meantime we will put your castings together."

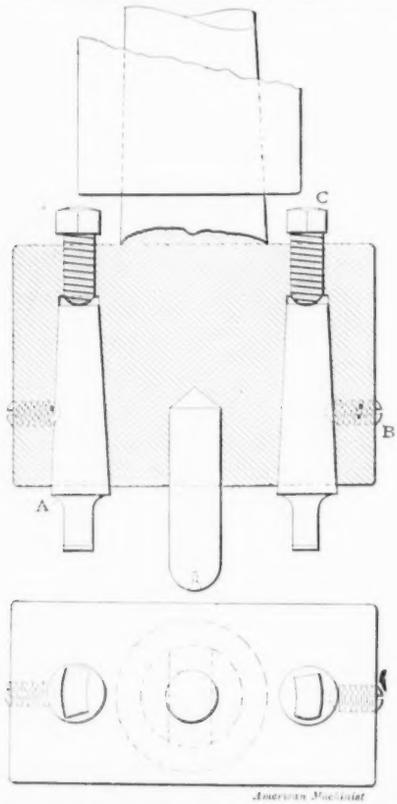
When I got back to the shop and told my partner that I had promised Mr. Jones to put his castings together and charge nothing, I had a warm half hour. Finally he said: "Mr. Dixie [he always calls me Mister when he is specially hot], you can do this fool thing if you want to, but I insist on your taking account of all the time spent on this something-for-nothing job, and paying for it out of your own pocket." This I agreed to do. Next day, the castings came in and I gave instruc-

tions to one of the apprentices what I wanted done with them. Six weeks later I notified Mr. Jones that I would like him to call and pay the amount due us and get his castings which had been put together. Next morning Mr. Jones, with a radiant smile on his face, put in an appearance at the shop; he had been successful in his search for money, and would write me out a check for the amount right away. "I'm sorry, Mr. Jones, but you see we are very hard up at present, and we have no bank account; can't you let us have this in cash? It's only two blocks to the Penn National where you have your deposit——" "Why, certainly," and off he went, returning in a few minutes and counted out the amount of our bill and got a nice new receipted bill. "Now," he said, "I would like to see them." So I piloted him down into the basement. "But, Mr. Dixie, these castings are not assembled; there are no finished machines in that heap." "Pardon me, Mr. Jones; if you will refer to my letters to you, and to my conversation at various times, I think you will remember that I told you I would put your castings together. Now, I have put them together—they are all together on the floor there piled up nicely so that your hauler will have no trouble hunting round for what belongs to you." DIXIE.

Tool for Cutting Holes in Flue Sheets.

Editor American Machinist:

The sketch shows a tool used in the



TOOL FOR CUTTING HOLES IN FLUE SHEETS.

drill press for cutting holes in flue sheets. The cutters *A* are made from the shanks of drills that have become too short for drill press use. No. 2 Morse taper shanks are used, the tongues of which are cut off. These shanks or cutters are turned to the required diameter in the lathe and properly cleared. The screws *B* are used to locate the cutters in the correct position. The set-screws *C* are for removing the cutters. The pilot or guide is of tool steel, tempered and lightly driven in the body of the tool. M. J. W.

Machining Half Bearings.

Editor American Machinist:

At page 604 "Junior Boss" takes exception to the method of machining bearings shown at page 277. He describes a method of handling this work which he thinks is well known to the readers of the AMERICAN MACHINIST. I have no doubt that it is, as it is precisely the way this work was formerly done in the shop where I am employed. As we work on the premium plan and as these bearings are done in lots of 500, it is important to the workman that the work be done as expeditiously as possible. By the method criticised we were able to turn out three times as much work in a given time as by the method described by "Junior Boss."

The advantages of machining half bearings by the use of the fixtures previously shown are: The soldering of the bearings together being done away with, this is quite an item in itself. The bearings are held more rigidly and will stand a *much heavier feed* than when chucked by the flange. In the turning there is no changing of tools, which is one of the most important items in rapid lathe work. The tools are set and held in a turret, the finished size of the work being partly determined by a graduated dial on the cross-feed screw. Again, the bearings are set central and ready to be turned in an instant. In fact, very often one can be turned in less time than was required to set it with a surface gage in the old way.

In boring these bearings on a horizontal boring machine, which is superior to a lathe for this purpose, the bearings are held firmly in a hinged chuck which is clamped to the table of the machine. The bearings are placed in this chuck instantly, and as the entire bearing is covered and clamped by the chuck it is capable of standing a feed "for further orders," and that is partly what gets there when you want to hustle work. C. S.

A Method of Holding Inserted Punches.

Editor American Machinist:

The method of holding punches inserted in a soft steel holder as shown in Fig. 1, is by no means new, although quite effective. Having occasion to do considerable punching where the tendency to pull punches out of holder was so great that they became loose although held in the manner shown in Fig. 1, a good, "husky" screw being used, I adopted the idea shown in Fig. 2, which I found worked to perfection. It will be noticed the end of screw is flat in this case, giving a good bearing surface, whereas in the scheme shown in Fig. 1 such is not the case, the point of screw (which is flat to conform to

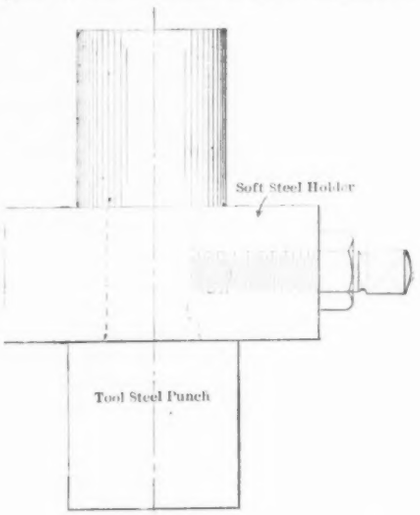


FIG. 1

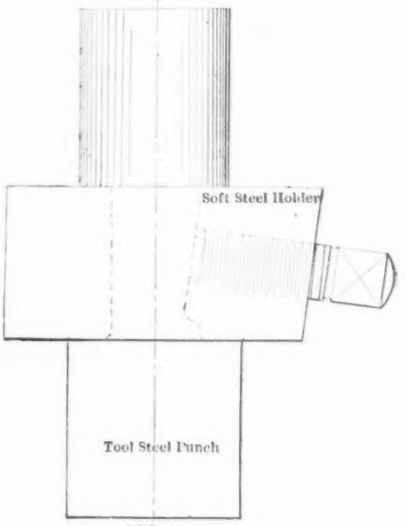


FIG. 2

A METHOD OF HOLDING INSERTED PUNCHES.

the angled flat on punch) having but a slight bearing. It is obvious that any tendency for the punch to pull out will only be the means of its becoming tighter, as it creates an added tension on the set-screw, which for this reason, if no other, makes it unnecessary to use a lock-nut of any kind. The punch should be rammed home by coming down on an end-grain hardwood block or piece of babbitt before punch is fastened. R. A. L.

Threading Duplicate Work.

Editor American Machinist:

When threading duplicate work similar to that shown in the sketch, if there is no male gage, the use of the micrometer in connection with a 60-degree point set over the anvil will be found quite convenient and a reliable method in getting the correct size, the work being first turned on the outside diameter to the size of the sample piece, or the proper allowance be-

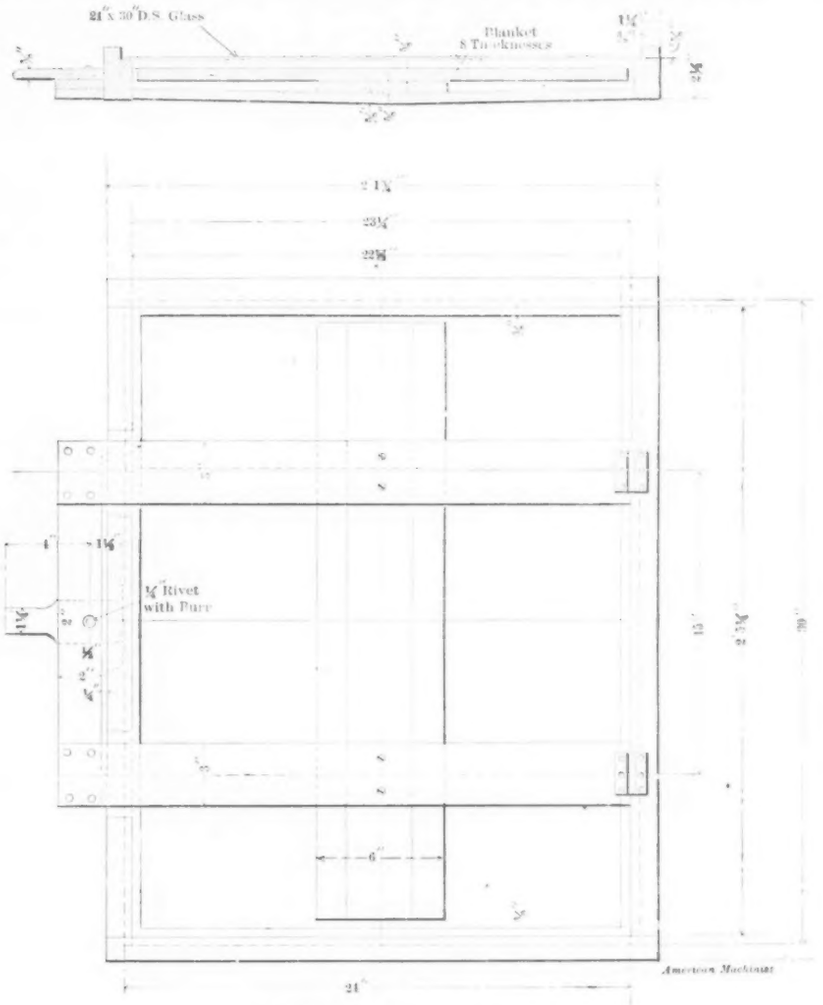
ing made for the difference in the diameters of the respective pieces. In threading a flange for a lathe chuck, I take the size in this manner off the small face plate that accompanies the lathe and usually get a good fit the first trial.

CHARLES SHERMAN.

A Simple Blueprinting Frame.

Editor American Machinist:

Some time ago I was much annoyed with a blueprinting frame which had a back board in three loose parts and a separate felt blanket and three clamping bars to be swung into place and buttoned.



A SIMPLE BLUEPRINTING FRAME.

Handling all of these parts was a great nuisance and took much time when many prints were to be made. It was necessary to turn the glass side down, in order to get the tracing and paper into place, and if they became disarranged it would not be noticed until the frame was all closed up and turned over, and then the whole tiresome process had to be gone over again. So I avoided these troubles in the frame here shown, by designing it with no loose parts and fastening with a single button. The sketch is, I think, clear. When putting the tracing and paper in the frame, I lay it, glass up, on a table next to the wall. I loosen the button and lay the frame and glass back against the wall, leaving the hinged crossbars and back board with blanket lying on the table. I then lay tracing and paper on the blanket and let the frame down with my arms, while I straighten the paper and tracing with my hands, seeing plainly through the glass. The glass is a selected pane of double-strength window glass, with as few bubbles or marks as possible, and the blanket is an ordinary bed blanket, costing perhaps 75 cents, cut up to suit and tacked around the edges of the back board. The two hinged crossbars give all the spring that is necessary for good contact of tracing and print. As the blanket pulls down tighter around the edges in tacking, I allow a margin of 1½ inches between frame and print all around, so as to have good contact. This frame has done very rapid and satisfactory work, and is a cheap affair.

S. A. WORCESTER.

Terse Sayings in the Drawing-Room.

Editor American Machinist:

There are many little phrases dropped in the drawing-room which are not appreciated at the time, but which nevertheless haunt the memory and arise at some future time as an illustration of the personality behind them. I wish to call attention to a few such which seem to be generally applicable.

A very capable man, now deceased, who was not only the promoter and president of a concern capitalized at millions but the mechanical genius as well, when looking over the drawings of a machine proposed to the draftsman to move a certain mechanism bodily from one position to another. The draftsman replied, "Yes, that may be done to some advantage, but it will look like a sore thumb sticking out on the side." "Huh! We're not running an art gallery," was the reply.

The mechanism was moved. Its location proved convenient and was not so unsightly as at first it appeared, which brings to mind another saying. A poor draftsman was sweating over his board one hot day in July trying to get a frame for a large machine. He had it O. K., except in appearance. The chief looked at it and said, "It isn't right." The draftsman said, "There is something about it doesn't look right." The chief replied, "When it *is* right it will *look* right." The draftsman found a few slight errors, shifted a curve or two, made an allowance here and there. It came out fine; looked right and was right.

A superintendent, in looking over some details, asked the draftsman how he was going to machine a certain surface. "Oh, they'll have to do a little chipping." "For heaven's sake, don't do any chipping in the drawing-room; it's expensive enough when we *have* to do it in the *shop*," was the reply.

A shop foreman once came into the drawing-room and asked the designer why he was so stingy. The designer, being rather sensitive, flushed up slightly. "Oh, I didn't come in to kick up a row, but just come out to the shop with me. See Mike trying to tighten up those bolts? Now, there could have been plenty of room, only you were stingy." The designer walked back to the office without saying a word, but you may be sure it did not happen again.

"Air doesn't cost anything," was a favorite expression of one man in charge of a drawing-room, while another, having the same idea but more in detail, used to say, "It's all out in the open." "Take room," "Don't crowd things," "Have some pity on the machinist's knuckles," "A molder isn't a ferret," "How's a fat man going to get past?" etc., etc.

The draftsman's future punishment, if he does not have enough meted out to him here, will undoubtedly be a solution having for its active principle negative clearance.

Regarding the harmonious development of a machine, as a whole, one engineer frequently said to his men: "A drawing's never finished until it's in the iron"; "You can't rub out iron, you can lines"; "What

you have done is not unalterable as the laws of the Medes and Persians; if you can't do this part any other good way, do the first part over again to suit this."

"But I can't get a 2-inch shaft through 1¼ inches of space."

"You're not using an old pattern; make that 1¼ inches anything to suit."

"But I'll have to change the other gear then."

"Well, it's not in the iron."

"Make it of gold if necessary," was an expression used by a well-known engineer to convince the draftsman that the very best was needed, irrespective of cost.

Draftsmen are often prone to "strain at gnats and swallow camels" if left to themselves. There are physychological reasons for this. One has trouble in proportions, clearances and operations with one part of a mechanism, and, in a concentrated desire to overcome the difficulties presented, is quite liable to overlook something of more importance, or, by reason of a sort of mental fatigue, fail to see the easiest and best way out of the trouble. At such times a word or two from someone else is often very helpful, and if a trifle terse it will usually remain in the archives of the memory for use in a future emergency.

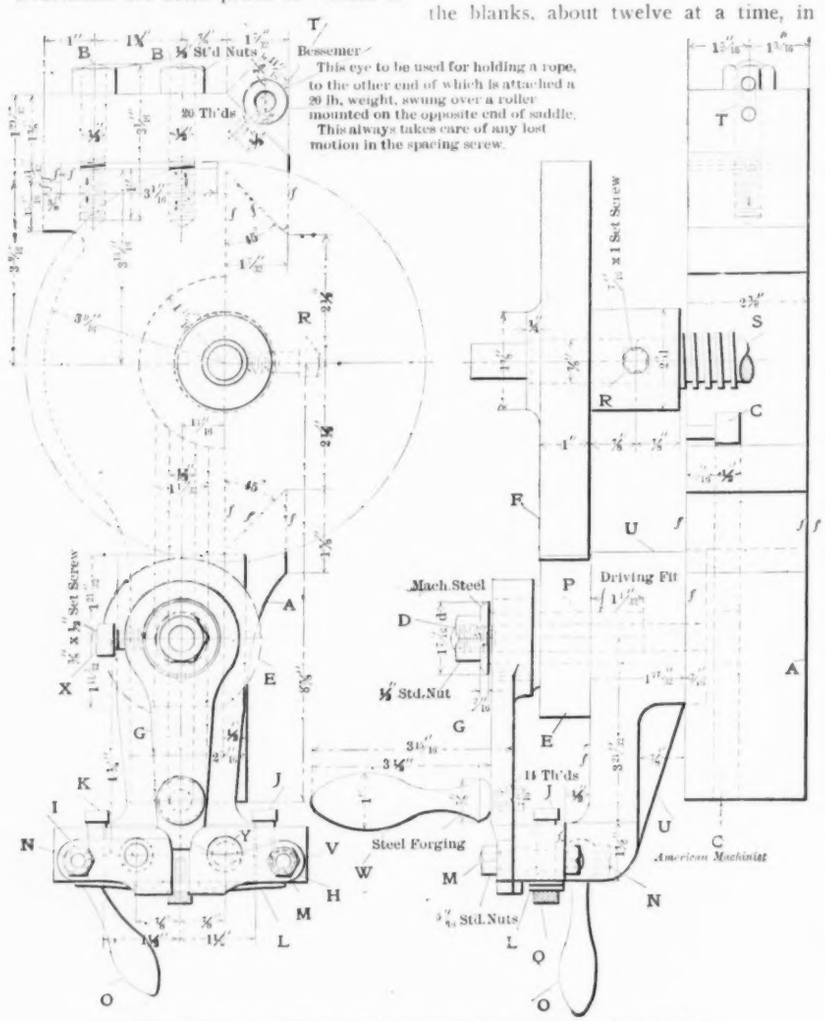
A DRAFTSMAN.

Correct Rack-cutting Attachment for the Milling Machine.

BY DRAFTSMAN.

Holding a position as chief draftsman for a company, the product of which requires a very excellent degree of perfection in certain parts, I have often been called upon to design attachments for milling machines, etc., which would produce the work in perfect condition at a cost not more than that entailed by the ordinary methods.

The case at hand relates to a method of cutting small brass racks of 32 pitch about 6 inches long. The previous method used to cut these racks was to clamp the blanks, about twelve at a time, in a vise on the milling machine table and by using the dial on the cross-feed screw graduated in thousandths of an inch, move the table the required number of thousandths for each tooth. This was a very slow and tedious operation, to say nothing of the inaccuracy caused by the lost motion in the screw not always being taken up if the indicator should chance to pass the required mark. To test the accuracy, two racks which had been cut at the same time were taken and one inverted and reversed end for end and meshed with the other. If they were absolutely correct, the teeth would fit into each other perfectly from end to end, but in nine cases out of ten they would show up very badly. Now this was one of the points to overcome, as unless they were perfect they could not be used and were consequently sent to the foundry as scrap. Another point was to so construct the attachment as to be "foolproof" against any green or careless operator, who was to blame for inaccuracy in many instances.


Bessemer
This eye to be used for holding a rope, to the other end of which is attached a 20 lb. weight, swung over a roller mounted on the opposite end of saddle. This always takes care of any lost motion in the spacing screw.
20 Th'ds
Mach. Steel
Driving Fit
½" Std. Nut
15 Th'ds
Steel Forging
American Machinist

CORRECT RACK CUTTING ATTACHMENT FOR MILLING MACHINE.

The accompanying drawing shows a plan, elevation and the detail parts of the attachment, for which but a few words will be necessary in explanation. *A* is a cast-iron frame which is clamped with the bolts *B* to the end of the table on the milling machine. It contains a T-slot *C* into which fits a square-head bolt *D* which clamps the slide *U* to the frame *A*. Mounted in the slide *U* is a stud *P* carrying a small gear *E* which meshes with a larger gear *F* on the feed screw *S* of the mill. On the hub of gear *E* is keyed a crank *G*, on the outer end of which is a case-hardened projection which engages with the locking cams *H* and *I*. These cams are mounted on a steel block *V*, which is bolted to the slide *U* with the screws *Y*; they are always retained in the position shown by having their journals *M* and *N* cut into pinions which mesh with racks *J* and *K*, these racks operated upon by the spring *L* which is clamped to the steel block *V* with the thumb-screw *Q*. To operate, release the crank *G* by pressing upon the handle *O* which is keyed to the journal *N* of cam *I*, thereby causing said cam to rotate and allowing crank *G* to pass down from right to left. As the crank finishes its revolution it comes in contact with the cam *H*, which it throws and strikes cam *I*, cam *H* returning to its original position, forming a positive lock. One revolution of the crank *G* or gear *E* moves the table sufficient for one tooth, the large and small gear so proportioned as to produce the right pitch.

With this attachment, the vise holding the blanks was bolted crosswise on the table of the mill and the cross-feed used to make the cut, this necessitating the use of the vertical cross-cut head, while the horizontal screw was used for the spacing. The tooth cutter was one of 3 inches diameter placed beside a face cutter of as much less diameter as twice the depth of the tooth, the latter being for the purpose of facing the stock preparatory to cutting the teeth, thus making the depth of all exactly the same, which was very essential. The eye *T* was used for holding a rope, to the other end of which was attached a 20-pound weight swung over a roller mounted on the opposite side of saddle; this always took care of any lost motion in the spacing screw.

I feel perfectly safe in recommending this mechanism for the cutting of racks or similar pieces in which great accuracy is required, for it is absolutely "fool-proof" and positive in its action, as a glance at the locking device will show.

High-Speed Tool Steels.

BY WALTER BROWN.

For several years this subject has been much talked of, but until lately not a great deal had been accomplished. Even now high-speed steel is only in its infancy, manufacturers being constantly under the necessity of experimenting and changing the constituents to secure better results. Even the best yet produced will have occasional hard streaks when annealed to its softest state, and flaws are of frequent occurrence. Another disadvantage is its greater hardness, compared with carbon steel.

In spite of its shortcomings, however, it is very evidently the cutting-tool material of the future; both because of its superior qualities, all things considered, and of the likelihood that most of its present failings will be overcome as manufacturers get a better knowledge of its nature and behavior.

The chief difficulty in the way of its use now is its exceeding brittleness. Many a user has become discouraged with the result of a few experiments and has, because of finding that it lacked the toughness of other steels, discarded its use entirely. More experience would have demonstrated without question the great value of this new product. The question of brittleness is largely a question of treatment, and experience will very largely obviate the difficulty so that it will be tough enough to stand up under any proper conditions of work. Every tool-dresser knows how to handle carbon tool steels, and is guided by his knowledge of its qualities at different temperatures as indicated by its varying colors. When he gets a high-speed steel he naturally treats it much as he would carbon steel. This is where most of the trouble begins. The smith must learn an entirely different set of color values and methods of treatment. He thinks that if he has succeeded in getting a hardness greater than that of his file, he has done his job. That, however, has nothing to do with the fitness of the tool. I have known cases where the tools would do the best work while still soft enough to take a good Swiss file. In other steels a similar degree of softness, or even a degree of hardness much greater than that of ordinary steel would not work, the tool "gumming up" and rapidly burning up. Our own experiences have been so interesting and successful that I have thought they might prove of help to others, and I submit them herewith.

The tools should be placed in a pipe or box, well surrounded with small pieces of coke, the packing case then being sealed up with fire-clay. Small holes must be left for the escape of gases, otherwise the clay will blow out. The heating furnace should have been previously heated to a white heat. The packing case is left in the heat from one to three hours, according to size. When removed from the furnace, the box should be as near the bath of fish oil as may be, so that there will be no unnecessary delay in transferring from the gases of the packing case to the bath. Exposure to the air not only causes scale, and therefore variation in size, but tends to affect the precision of the hardening process. Observance of this caution will prevent excessive variation.

The method of packing will depend somewhat upon the shape of the tool. It is important to pack in such a way that all tools packed in one case be so placed as to be handled very quickly, and at once plunged into the bath, to prevent scaling by reason of contact with the air, as explained above. In the case of milling cutters and keyseat cutters, a good way is to suspend them all from a rod, each separated from its neighbors by a slight space, sufficient to allow a free circulation of oil when plunged. Neglect of this precaution will be very likely to cause cracks, from the unequal contraction of the cutters, the outer edges only being brought into immediate contact with the bath, and therefore shrinking more rapidly than the interior parts.

For taps, drills and similar shaped tools this hardening leaves the steel too brittle, and as soon as the tool has become a little dull it breaks off. To avoid this the tool can be drawn as can a carbon steel tool. But here, too, a new set of color scales must be learned. The blue heat of carbon steel is not enough for the high-speed steel. The heat must be carried on until the metal reaches a greenish tinge. It is then allowed to cool in a dry place free from air drafts.

It is now much tougher and softer than before. In case it needs still further softening, it can be done by reheating, bringing it to a faint red, dull enough to be perceptible only in a dark place (an empty nail keg is convenient for this use), and then cooled as before. We have made taps as small as 5-16 inch in diameter to be used in an automatic nut-tapping machine, about the hardest work to which a tap can be put, with gratifying results. In the test three taps cut 92,000 nuts, an average of almost 31,000 nuts per tap; with carbon steel taps we cut 6,000 nuts per tap. No effort was made to speed up the machine, the test being one of durability only. The carbon steel taps cost about 10 cents, and the high-speed taps about 40, or four times as much. The latter, however, cut about five times as many nuts. Besides this, there is also to be taken into account the more important saving in the time formerly used in stopping the machine, removing and grinding taps, which is five times as great when carbon steel taps are used. This is not mentioned as a particularly demonstrative test, but merely to show that high-speed steel can be profitably used for small tools, if properly treated. Another place where we are using high-speed steel with profit and satisfaction in small tools is in drills. The saving here is very marked; but the statements and claims of several makers of such drills are not verified by our experience. We find that we can run such a drill at about double the speed of the ordinary drill, and at the same time cut more holes.

Makers of the new steels are in the habit of making large claims as to speeds attainable. We have tried about every such steel on the market, giving each a thorough test. Our experience usually bears out the moderate statements, and sometimes the extravagant ones put forth by some makers, as to what is possible. For instance, we have cut a 1-16 chip, 1-32 feed, at a rate of 266 feet per minute peripheral speed, from a rod of machine steel. Such speeds are possible for short periods; but whoever buys rapid cutting steel with the expectation of maintaining such speeds will be sadly disappointed. With a fine feed even 400 feet per minute can be cut under very favorable circumstances; but think of the chip that comes off! In case of steel the chip is no such thing as we are accustomed to, breaking into short pieces and dropping into the box below. At a speed of, say, 200 feet per minute the chip comes off writhing and twisting, almost red hot, in a continuous length, shooting here and there, everywhere but into the chip box; and quick must be the workman that manages to keep well out of the way of it, for it "sticketh like a brother" when once he gets tangled in it. Possibly in time a way will be found to take care of such chips. Until this is done, however, a moderate speed is most desirable. We find that on steel, where there is no considerable thickness of metal to remove, a speed of 100 feet a minute is very satisfactory. This allows taking care of chips, and the tools stand up well under it. In turning gray iron, where the scale is to be removed, about 70 feet per minute is giving us the best results. Naturally, however, there being so many different kinds of materials to work up, and each one of these varying more or less, there can be no set rule for speed. Each job will work out a rate for itself. The main thing is to get out the job as fast and as well as possible, and at the same time to lose as little time as may be in grinding the tool.

Another word about the saving to be effected: This will depend, among other things, upon the number of machines that are run. If only one machine runs on a job, there will not be a saving of two-thirds simply because the speed is trebled. It must be remembered that perhaps 50 per cent. of the time for doing a job on a single machine is used in jigging the piece and setting the tool.

The high initial cost of the new steels has made it necessary to devise means for reducing the quantity of metal in the tools used. The result has been the production of some very ingenious schemes for holding cutters. The lathe tool-holder is, of course, familiar to all. Milling cutters, hollow mills and reamers with inserted

teeth are scarcely less familiar. It is now true that we are making all these tools with inserted cutters of rapid cutting steel at less than that of the cold carbon steel tools. At the same time they are doing from three to ten times the work and at a much greater speed.

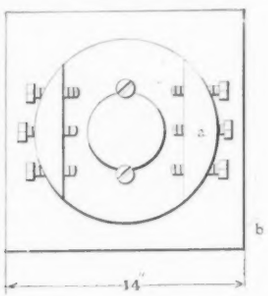
Inquiry for Catalogs.

Messrs. R. S. Stokvis & Zonen, of Leuvenhaven, O Z 74-76, Rotterdam, Holland, after sending a representative to this country to familiarize himself with American methods, have established an engineering department, and desire American machine tool builders to send catalogs, of which they contemplate making as complete a collection as possible. The opportunity of placing catalogs in this way would seem to be one well worth taking advantage of, even if it may not be easy to tell the way the good may come.

Method of Making a Ball Vise.

BY C. L. G.

Fig. 1 represents a special vise for use on a die-sinking machine. The vise has a half-spherical work-holding member *a* and a base *b* in which the former lies. The work-holding member may be swung and securely clamped so as to present a piece of work up to 20 degrees from a horizontal plane. The clamping of the swinging member is by means of a bolt *c* passing through the center of the vise.



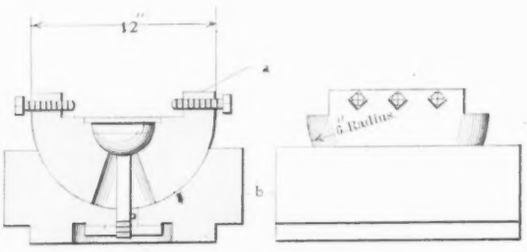


FIG. 1

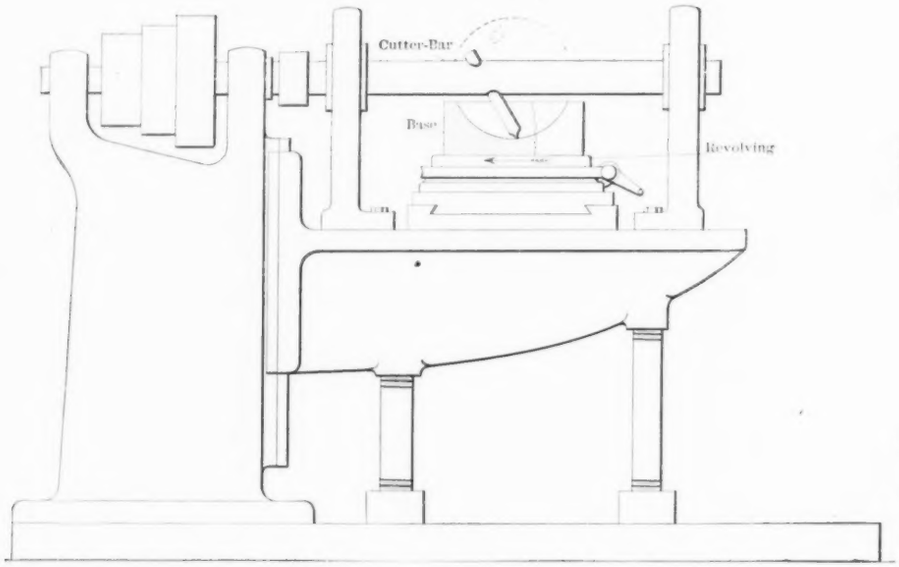


FIG. 4
MAKING A BALL VISE.

The various uses to which a vise of this design may be put are many, but will not be dwelt upon here, the method of making the spherical members being that to which attention is brought.

The half ball *a* was of gray iron, and was provided with temporary ears for convenience in clamping the piece to face-plates, etc. After the planing of the top face and recess had been done, the half ball was clamped with its top face to a 90-degree knee located on the face-plate of a 27-inch engine lathe as in Fig. 2, and a cut about 1 inch in width, of the exact radius desired for the finished ball, was carefully taken, as shown. This cut gave a perfect templet, or rather a guide to follow in the succeeding operation. The half ball for this latter operation was clamped, as in Fig. 3, with its top face

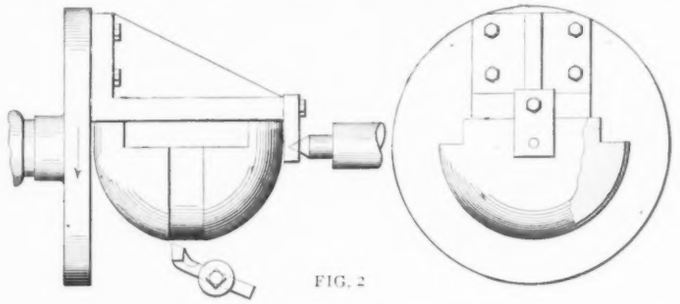


FIG. 2

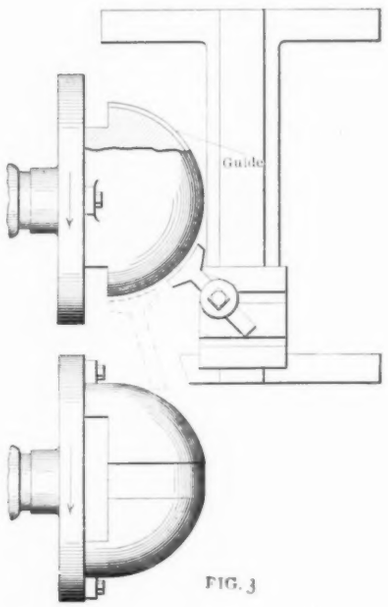


FIG. 3

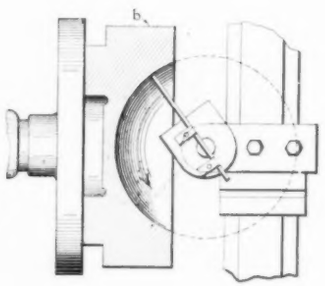


FIG. 5

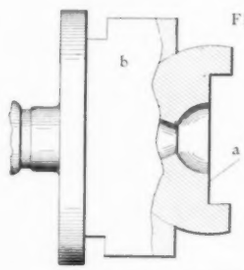


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FIG. 6

direct to the face-plate instead of to a 90-degree knee as in the preceding operation, extreme care being taken to locate the work absolutely central in respect to the cut taken in the previous operation.

The half ball was then roughed out by a round-nose tool and finished by a forged formed tool having a radius slightly in excess of the ball and about 2 inches wide. This lathe tool was held in the tool-post and adjusted to the guide cut before being clamped, and then the finishing cuts were taken. The tool was adjusted for each cut in the above manner and left the ball very smooth; in fact, no polishing was required.

The base piece *b*, which was also of gray iron, was first carefully planed at points requiring it and then strapped to a horizontal boring mill having a revolving table as shown in Fig. 4. The cutter in the cutter bar shown was adjusted so as to bore to the same radius as the half ball. The revolving table was carefully positioned on the table of the boring mill, so that a continuation of its axis would intersect the axis of the cutter bar.

The revolving table, together with the base piece, was slowly turned while the cutter bar was rotating, and a perfect spherical-shaped cup thus formed.

The base piece was next clamped to the face-plate of an engine lathe, Fig. 5, being centrally located by an ordinary multiplying lathe indicator. A swinging tool-carrying block was bolted to the lathe carriage in such a position that the center of the stud on which the block swung intersected the center of the cup in the base.

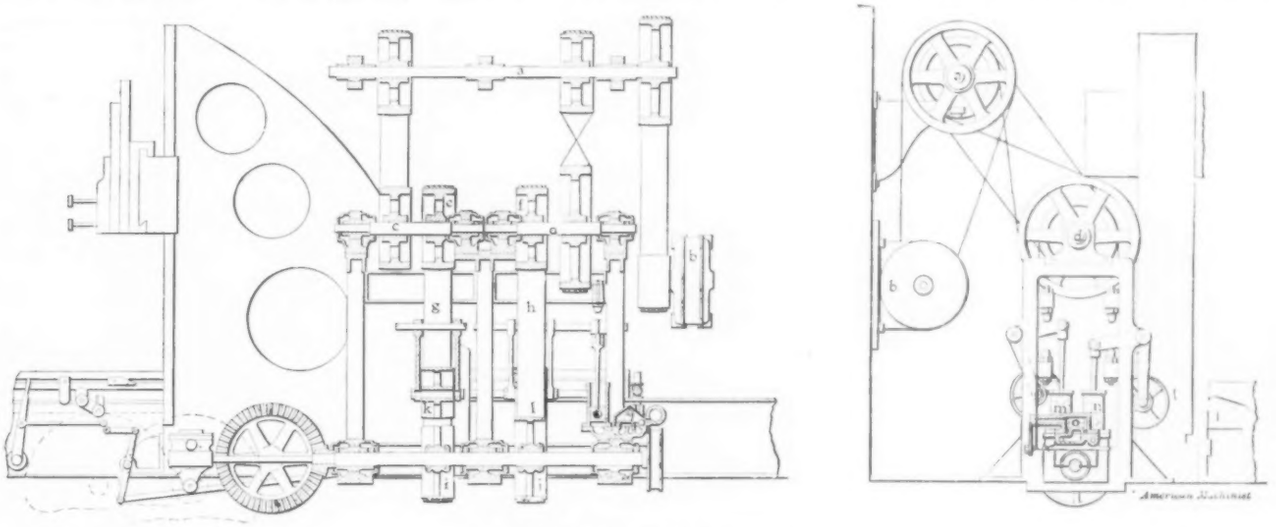
This center was readily found by means of a pointed bar clamped on the swinging block to the same radius as that of the cup, it being obvious that when the point of this bar, which was on the exact line of the lathe centers, and swung from the stud, was in continual contact with the cup, the swinging block was properly located.

The work-holding member *a* was then placed in the base piece, as in Fig. 6, and the small cup in the former bored by means of a cutter held in the swinging block, by slowly swinging the block, the work, of course, revolving simultaneously. This resulted in the inner cup having the same centers as the other spherical surfaces and a perfect form.

The clamping bolt *c*, Fig. 1, was finished by a forged forming tool, so as to fit the small cup.

A New Planer Drive.

We illustrate herewith a novel belt drive for planers which has been applied to a 7-, an 8-, three 10- and a 14-foot planer at the works of the British Westinghouse Electric & Manufacturing Company, of Trafford Park, Manchester, England, by Mr. W. C. Mitchell, who is, we understand, connected with those works. The drive has supplanted both shifting belts and magnetic clutches, the machines to which it has been applied having been



THE MITCHELL PLANER DRIVER.

speeded up when the change was made to take advantage of high-speed cutting steel, the present speeds being as shown in the table:

	Speed Cutting Stroke.	Speed Return Stroke.
7 ft.	53 ft.	132 ft.
8 "	50 "	125 "
10 "	36 "	80 "

One of the 10-foot machines has now been running with this drive attached for about a year and, we are informed, with highly satisfactory results. The working parts seem to be in as good condition as when the drive was attached.

The leading feature of the drive is the substitution of vertical belts having a surplus of length and with tightening pulleys on their slack sides in place of the usual shifting belts. There is a forward and a backing belt with a tightener to each. These tighteners are operated in succession, one being loosened and the other tightened at each reversal of the machine. In the case of the 7- and 8-foot machines the tighteners are operated directly from the table trip dogs, but in the larger machines this operation of the tighteners is by the agency of compressed air, the latter construction being the one shown.

With shifting belts the action of the reversing mechanism is to suddenly throw the entire power of a belt upon the reversal of the machine, there being no graduation of either the quickness with which the belts are applied or of the intensity of the effort. With the device shown, especially in the form in which compressed air is used, the quickness of the application may obviously be adjusted to suit the results and with both forms the effort of the belt may also be graduated by suitable adjustment of the tightener pulleys. Moreover, it is well known that the factor which limits the amount of power that can be put into a planer with the ordinary drive is the difficulty of shifting large belts, a difficulty which grows both with the size of the planer and with the requirements of high-speed steel and which is obviated by the drive here shown.

The accompanying illustrations show side and end views of the drive. At *a* is a short line shaft which may be driven from the motor *b* or from any other source of power. At *c* and *d* are two counter-shafts which are driven by open and crossed belts, respectively, from shaft *a*. Upon *c* and *d* are two pulleys *e f* from which hang the belts *g h* which are long enough to embrace the pulleys *i j* loosely. At *k l* are the tightener pulleys which are operated by the compressed air cylinders *m n*, of which the common valve *o* is operated by the usual dogs upon the planer platen. The pulleys upon the line and counter shafts will be seen to be very heavy in order to secure a suitable fly-wheel effect, and it will be observed that at each reversal the combined effect of *all* the flywheels is secured.

Echoes From the Oil Country—Natural Philosophy in a Job Shop.

Tom was boss when he happened to be around, and when he wasn't around Johnnie was boss. If they both happened to be away the oldest of the boys was boss; that is, if he happened to be the right kind of a boy. If he wasn't, one of the other boys took up the burden of responsibility.

I do not know that anyone had ever planned it to be that way. It just naturally seemed to plan itself, as you know some things will if they have a chance to. When a man came in with a job, it was well known by all the force that it was a disgrace to let him go away without leaving the job. If they could not do the thing that he wanted done, they might do something else that would take its place. If the real boss did not chance to be at hand to take the order, it was someone else's duty to take it, and not only to take it but to see that it was done. If he could not do it himself, on account of the press of other jobs, he turned it over to someone else who was not so busy. You see, this was a job shop, and if jobs did not come in times would be slack. Everyone was interested in seeing that everything in sight did its share in keeping things going. Often a job required that a man should go to the job instead of its coming to him, and often someone had to go and look the ground over and plan how to reach certain desired results, and such things took the boss and the men away quite often. It is not hard to understand that under such conditions the treatment that jobs received varied according to the hands of the man they happened to land in. Each temporary boss planned the job on hand as seemed to him best at the time.

Tom was away when a team drove up with a load of odds and ends of 8-inch and 10-inch pipe. There were tees and ells with short nipples in them; there were couplings with nipples and bushings in them, and many variations of the various things. These things were alike in one way—they all showed the marks of hammer and tongs. It was very plain that they were the "stickers" that could not be taken apart with the regular means.

"The superintendent of the gas company told me to bring these in. He wants you to take them apart. He said you could ketch 'em in the chug of the big la' you have in here and take 'em apart by machinery, and do it cheaper than he could. You see yourself that he hasn't got room enough to put on tongs enough to get men enough to pull hard enough to get them apart."

Johnnie had his own ideas as to the best way to get them apart, and he also knew how hard a chuck could sometimes stick when it was wanted off, and how easily it would let go when it was being used to pull backward.

"Here, Jimmie, help to carry these down into the blacksmith shop, and then get a couple of monkey-wrenches, a pail and a big handful of dirty waste, while I am building a fire. I will want you to help me for a while."

Johnnie was small, and not very strong and he knew that large, strong men had been at work trying to get those fittings apart. He made up his mind that he would use a little natural philosophy in his work. Tom used to say that Johnnie never used any muscle when he could help it, and that was the reason that he had not grown any bigger. Tom was a splendid specimen of rugged, muscular manhood, while Johnnie used to hint that a man who had too much muscle was apt to depend on it to the neglect of his brains.

Soon Johnnie had a small fire going. It was about a foot and a half long and as narrow as he could make it. He took an 8-inch ell with a short nipple in it for his first demonstration, and put it in the fire so as to do as little heating to the nipple as possible while heating the part of the elbow that the nipple screwed into. To help the matter along, he laid some bits of wood up around the elbow. He used a lazy man's blast, and turned the piece around carefully so as to heat it as evenly as he could. The pailful of water stood at hand, and the waste was wired to a short piece of iron and stuck into the pail. When the heat was up to please him he stuck a piece of wood into the free end of the ell and directed Jimmie to sit down on it and keep it from turning. The monkey-wrench was on the end of the pipe in such a way that it would turn the pipe out when it was loose enough to come easily. Shutting off the blast, he swabbed the pipe on the inside, where it screwed into the ell, with one hand, while he put what pressure he could on to the monkey-wrench with the other. To his joy the pipe moved a little. Another swabbing, and it moved a little more. At the third swabbing it did not move, and the blast was put on and the performance repeated, and this time the pipe let go enough so that it was screwed entirely out.

"There, Jimmy, my boy, you see how easy that was. We will get this all apart without straining our insides out. The next piece we will try will be this T with the two nipples in it. You will have to use this other monkey-wrench to hold back on, but you see what I am trying to do now."

Jimmie saw and was wideawake. It was lots easier to sit on a piece of board or hold back on a wrench than it was to try to think what Tom meant when he yelled and lifted and tugged, and wanted everyone in sight to do the same thing.

Piece after piece came apart nicely until a rather long piece with an elbow was reached. By this time the fire had become large and broken, and it was hard to get the heat where it was wanted, and besides that it was hard to see just where the swab was being applied, and the pipe did not start back even on the second trial. Johnnie loked at it a bit, and had made up his mind that he would make time by rebuilding the fire, when Tom put in an appearance.

"Hello, what are you fussing with down here?" he demanded.

"Gas company wants this pipe taken apart," answered Johnnie, shortly. That word "fussing" hurt his feelings. He pointed to the pipe that was all together. Tom did not see the pipe that had been taken apart.

"Don't you know how to take pipe apart yet?" he asked, sarcastically, and then without waiting for an answer he added, "How long have you been working at this?"

"'Bout two hours," muttered Johnnie.

"Two hours!" shouted Tom. "You must forget that you are getting pay for your time. I'll show you how to take pipe apart: Don't you know enough to build up a decent sized fire even?" And he put the blast on strong while he heaped the coal up around the fitting. When it was a good red hot he pulled it out and swung in over the water barrel and barely missed getting a face full of water from the inside of the pipe.

Looking around he exclaimed, "Where are your tongs?"

"We haven't any tongs for that size pipe," replied Johnnie. Tom knew that, too.

"What are you using, a chain and a bar?" he demanded.

"We haven't a chain that is long enough," said Johnnie.

"It seems to me that you are old enough and have worked around long enough to know that you should get what you need to do a job before you go off half cocked," said Tom, looking at Johnnie severely, while Jimmie tried to keep out of sight for fear that he would come in for some of the blame.

"I have seen other folks that went off less than half cocked, but if you want to finish this job I will go back upstairs. A boy can help you just as well as I can. I had all the tools that I wanted on the job, and would have had that apart and a couple more if you had not come along."

"If you are so wonderful smart I would like to see you take it apart," and the tone was more than a little sarcastic. Tom remembered more than one tight joint that he had tugged, and strained, and swore, and sweat over.

Johnnie built up the fire to suit his own ideas, measured on the handle of the swab where it would bring the waste right, motioned to Jimmie to take his place, and presto! that pipe came apart as it shou'd do, and was laid over on the pile with the others.

"If you will keep away and not try to help me any more I think Jimmie and I can finish the lot this afternoon," he said, as he picked up another piece and laid it

carefully just where he wanted it in the fire.

"I guess you don't need any of my help. These little lazy fellows have ways of their own of doing things that no one but a real lazy fellow could make work." And Tom walked off and left Johnnie and Jimmie to finish in their own way.

Bad feelings between them after that little flare up? Not a bit of it. Each one worked according to his own nature, and when these ways chanced to cross each one said what was in his own mind according to his disposition, and when it was over each one was ready to forget all about the way it had been told. The work of the shop gradually found the ones that it suited best. W. OSBORNE.

The St. Louis Exposition—V.

EDITORIAL CORRESPONDENCE.

At one time during the past week there was a considerable "state of mind" among several representatives of tool builders here, who by special effort and in response to strenuous urging had gotten their stuff on the ground in time for exhibition on the opening day, but were not, at the time I talked with them, nearly a month later, able to complete their exhibits because a railroad track passed by them. On this track very noisy automobile cranes and freight cars and locomotives were continually passing. The aisle through which they passed is so narrow as to make things lap over into exhibit spaces, so that portions of exhibits designed to go on that side contiguous to the tracks could not be put in place but simply lay around cluttering up the rest of their spaces. The track was about 2 feet above the floor line and a general all-around nuisance. All efforts to have it removed seemed to be fruitless, because certain exhibitors who were late wanted it to remain until all their heavy pieces had been brought in on it in place of being rolled in, as would otherwise be necessary. Exhibitors thus delayed through no fault of their own and to accommodate other exhibitors who were late naturally felt very much aggrieved and used very plain language in expressing their opinion of the exhibition and of everybody connected with it.

If these men have anything to do with determining the question of whether their respective houses will exhibit at the next exposition, the decision will certainly be against it.

At Paris one heard very much about what 20 francs judiciously handled would do in facilitating the delivery of cars containing goods for exhibition, and there is no doubt that there was much of this petty bribing there. Americans like to think they and their countrymen are different in this respect, but there is almost as much and as persistent talk of that sort of thing here as there was at Paris. It is stated by a number of exhibitors that $3.00 given to a brakeman and another $3.00 to an engineer have enabled cars containing machinery or parts of machines to be put into Machinery Hall immediately when it had been declared that they could not be put in immediately and that no one could tell when they could be put in.

EXPENSE OF EXHIBITING AND OF LIVING.

Exhibitors declare, too, with practical unanimity that the expense of maintaining an exhibit here is much greater than at any other of the great exhibitions of modern times. Men are here who have had the experience upon which to base comparisons. Whether this is more than would be accounted for by the general advance in the cost of living that has taken place during the past few years, it is difficult to say; but it is quite certain that expenses here are considerably higher for the same grade of accommodations than they were at Chicago or at Paris. President Francis, speaking at the Press Congress, told how much money the citizens of St. Louis had subscribed for the fair, declared they did it from patriotic motives, and did not expect a cent of it back. Those of them, however, who happen to be in a position to charge visitors for things they need are getting a few cents back in that way. Hotel keepers in the western portion of the city will, without the blink of an eye, ask you $6.00 a day for a room without bath or running water—a room dear at $2.00 a day in New York city. This of course is a detail of the general rise in rents that has taken place and which is working real hardship to many St. Louis citizens. A friend of mine living here told me of one case of a man who had been paying $60.00 per month rent for the house in which he lived. The rate has been raised to $175.00 per month and the man declares he can do no better than to remain and pay it. This increase in rent is of course representative of St. Louis' present guess as to the value of opportunities to get money out of visitors to the fair. There are those who think that the guess is too high and that there will be a slump. The value of the opportunity will of course decline toward the end of the exhibition, but some of those who are at present paying the higher prices are anxiously wondering whether or not the decline will be to the former level; especially workingmen and others employed in the city whose incomes are fixed, or practically so, and who have no opportunity to get at the visitors' pocketbooks but must pay just the same as tho they had such opportunity.

CRANE SERVICE AND CHANGES OF PLANS.

That there has been mismanagement goes without saying; partly because there probably must always be more or less of that in every exhibition, and usually no one can put his finger on the one responsible for it.

With regard to facilities for installing exhibits in Machinery Hall, certainly some queer things have been done.

In the first place, it was planned to have overhead traveling electric cranes arranged to cover the entire central bay of the hall. At one end of this central bay are most of the large engines and dynamos, while at the other end of the same bay is the exhibit of the Niles-Bement-Pond Company, which, as before stated, contains some very heavy tools and amounts altogether to about 1,000 tons. The runway for the cranes is a separate timber structure, the weight not being carried by the building. Timber was purchased and delivered on the ground for the construction of this runway throughout the entire length of the building, but after considerable "backing and filling" it was finally decided not to construct it the full length but down as far as the Allis engine only. This belated decision cut the Niles-Bement-Pond Company out of the use of a crane entirely and, to make the situation more interesting for them, they had put in at an early date one of their own cranes which was in service all winter on that part of the runway which was built and it did the work incidental to the erection of the large engines and generators. They made no charge for it; simply loaned it to the engine builders and to the Exposition Company, expecting as a matter of course to be able to use it in the installation of their own exhibit. Instead of this, they have been compelled to pay heavily for the handling of their heavier pieces, for the rule is that the freight charges cover the delivery on the exhibitor's space of all pieces or packages weighing up to 3,000 pounds, while above that weight the General Service Company, which handles the stuff, has nothing to do with it and the exhibitor must make the best arrangement he can with a contractor who has facilities for doing such work.

That such contractors aim to get "all the traffic will bear" is shown by the experience of an exhibitor who wanted a machine moved along the floor to his space. They wanted $100 for moving it. He "kicked" and they came down to $75. He offered $30, and upon their refusal to do it for that moved it himself with his own men at a cost of $18.

The experience of the Niles-Bement-Pond Company being what it is, there is little wonder that they were able to hold a certain railroad track reaching their space long after other exhibitors wanted it removed and were protesting vigorously against its remaining.

It is said that the Niles representative was shrewd enough to keep directing attention to a certain car carrying some very heavy pieces and which is still in East St. Louis between two wrecked cars, while he in the meantime rushed in all the other cars he could containing smaller pieces, regarding which he was really more solicitous than about the one car with the heavy piece.

But, at any rate, on May 23 the track was being taken up and a number of exhibitors whose exhibits could not previously be completed were relatively happy and busy.

The Niles people, so far as I know, make

[Continued on page 743.]

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The Steam Turbine for Marine Propulsion.

We learn from *Engineering*, of London, that two unique opportunities will shortly be presented in England for comparison between the reciprocating engine and the steam turbine as the motive power of steamships—one of these opportunities being in the merchant service while the other in the navy.

The Midland Railway Company is shortly to undertake the construction of four vessels for the new Heysham and Irish service, two of which are to have reciprocating engines, while the other two will have turbines. All four vessels are to be alike in all respects with the exception of the propelling machinery, and the opportunities which will be presented for the comparative trials of the two systems of propulsion are thus unique.

In the navy, opportunity will soon present itself for the trial of two torpedo destroyers and two third-class cruisers, the only varying condition in each class of ships being again the propelling machinery.

Independent comparisons in the two classes of ships are of course essential, since owing to varying conditions such trials in one class of ships would have very little application to the other. One condition alone would vitiate all deductions which might be made for one class from experiments upon the other. This condition is due to the fact that while merchant ships operate normally under full speed and power, naval ships, in times of peace, operate under full power but a small fraction of the time and the operation of the turbine under reduced power involving as it does in ship propulsion reduced speed, introduces an element which is entirely foreign to any application of the turbine that has been made in stationary service, in which, while the power may vary, the speed remains constant. Inasmuch as the principle of the turbine involves a correct relation between the pressure of the steam and the velocity of the buckets, it will be seen that there is enough here to raise doubt regarding the entire applicability of the turbine to ships of war.

With ships which are twins in every respect except their propelling machinery it would be entirely feasible to send them to sea together and thus make the trials under precisely the same conditions of sea and weather. All conditions surrounding such trials would thus be identical with the single exception of the condition under test and the results will thus be under direct observation without all sorts of allowances and corrections for varying conditions.

The ships which are to be built by the Midland Railway are to have a displacement of 2,600 tons at 13 feet 6 inches draft in the case of the ships driven by reciprocating engines, and 2,400 tons at 13 feet in the case of the turbinedriven ships, the reduced weight being practically all due to the adoption of the turbine system. The vessels are to be 330 feet long and have a beam of 42 feet.

The Heating of the Shaving.

Another instance of the wonderful which is not so wonderful in modern achievement is to be found in the action of the high-speed steels in removing heavy shavings of metal at speeds much greater than have heretofore been considered possible. It may perhaps be proper to suggest that in the accounts that have been given of these performances and in the theorizing which has been done toward their adequate explanation not enough attention has been given to the heating of the shaving. The mistake has been in considering this heating of the shaving as an after effect of the cutting operation instead of as an actual accompaniment of it and as embodying in itself one of the essential conditions of success. Indeed the heating of the shaving has been spoken of as one of the objectionable things about the use of the high-speed steels.

Of course we all know that more force is required for the removal of a thick shaving than of a thin one, and for a very thick shaving very great force is required. And yet, why? If the metal is homogeneous, as steel is, there can be no more force required for severing a portion of it from the rest at one point than at another. For any given area a shaving an inch thick cannot possibly hold more tenaciously to the body of the metal than one a tenth of an inch thick. The action of a proper cutting tool is that of a wedge in either case, only the extreme apex of the wedge doing the actual severing of the metal, but after the shaving is separated from the body of the metal it must still get away from the inclined side of the advancing tool, and to do this it must be bent and for this bending force is required. The difference in the force required for removing the thick shaving as compared with that for removing a thin shaving seems to be chargeable entirely to the bending of the shaving and not at all to the separating of it from the body of metal. As metal bends more easily when hot than when cold the heating of the shaving by the friction and pressure of the tool in the act of "cutting" is evidently a very important factor in determining the force required. It takes much more power proportionately to remove a shaving of given section when running slowly than when running fast, just because in the latter case the shaving is hot while in the former it is cold. The heating of the tool is no advantage, and there is a limit beyond which the heating of the tool point by the act of cutting cannot be profitably carried, but there is no such limit to the heating of the shaving. Indeed it would be quite possible, theoretically, to help tool and shaving to still more astonishing results. We could imagine a jet of liquid air impinging upon the tool as near as possible to its cutting

edge, and thus keeping it as cool as possible, and another jet of molten metal playing upon the chip as close to its bending point as possible and thus helping to heat it still more. This arrangement, tho practically impossible, would certainly make the bending of the shaving easier and add to the force sustaining strength of the tool. The general use of liquids for cooling chip and tool and work all together seems to be very necessary to keep down the temperature of the surroundings, or of the job as a whole, but it probably has little effect upon the point of the tool or upon the shaving until it has passed the severing and bending points.

St Louis Exposition—V.

[*Continued from page 741.*]

no complaint about all this, tho to a man up a tree it would look as tho they would have been entirely justified in presenting an ultimatum—"No crane, no exhibit." As it is, the expense of installing and attending to their exhibit will be in the neighborhood of $125,000, and without it the machine-tool exhibit would have been a very small one for an international exhibition.

Of course, I have no means of knowing who is to blame for the change of plans regarding the crane runway, and perhaps no one is; but that the advice of experienced experts has been disregarded in some cases seems certain. There is a story to the effect that the man who first had charge of the matter of rail transportation for freight within the grounds was an experienced expert in such matters and laid out a plan which he thought right. He was told to make a new one and to cut it down. He did so, and upon its presentation was ordered to cut it down again. He declared that anything less than he had then planned would be entirely inadequate, that the authorities were only arranging trouble for themselves, for the transportation man and for exhibitors, and he resigned; a man being put in his place who has less experience upon which to base anticipations of trouble, but is gaining some as he goes along at the expense of the exhibitors and of the exhibition.

VAIN PURSUIT OF KNOWLEDGE.

Another exhibitor has to have a supply of compressed air to work a portion of his exhibit. Being ready for it on the 23d, he went to the Administration Building and saw the man who has charge of that along with other things. This man actually confessed himself not only unable to supply the air, to give any idea of when he could supply it, or in what condition the plant for supplying it then was. In fact, he could give no information about it more than an outsider could have done. Now of course it is possible there is a good reason for this state of affairs, but it does not seem probable that there is, and at least in the absence of such reason being given an exhibitor can scarcely be blamed for concluding that, somewhere, there is a good deal of laxness and inattention to business.

I have not come to St. Louis simply to find fault and criticise things, but up to the present time very few really new things in our line are to be seen or are ready for being photographed and described. There will be some of these later and we shall take them up in due time. In the meantime it seems proper to relate as accurately as may be the experience of exhibitors, all of which is tending toward the growing conviction in the minds of machinery builders that expositions don't pay and that it is better to keep out of them.

A good many Indians are in the exhibition, on the "Pike" and in the Indian villages located in the western portion of the grounds, but in the power plant an Indian may be seen who is not here for exhibition, but to work and to gain experience. He is a Sioux who usually goes by the name of John Dillon, but whose Indian name is Shasha (or Rosy-cheeks). I found him looking after a row of small Westinghouse vertical engines, and he told me he had been to school at Carlisle, had worked all winter at the power plant helping in the erection of the big Westinghouse engines and dynamos, is especially interested in electricity, and intends, after he gets through here, to finish his technical education in California. After that, or at least eventually, he hopes to be in business for himself in electrical lines.

AN ADDING MACHINE FACTORY.

St. Louis is called the home of adding machines. Several of them have been developed here, and three are now manufactured in the city. The principal one, however—the American Arithmometer Company, which makes the Buroughs adding machine and employs 425 men—is building new shops in Detroit and expects to remove there in the Fall. Mr. Boyer, of Boyer hammer fame, is president of the company, and it will be remembered that we published some time ago a very full account of the new shops built by the hammer company at Detroit. The new shops of the adding machine company will be built across the street from them and will be very similar but with such improvements in detail as can now be thought of. In the meantime the company is occupying here the old shops of the Boyer company, which were excellent for their time but are now much crowded. The superintendent of them is D. E. MacCarthy, who for some years has been an occasional contributor to our columns and who when he writes always has something to say, while the business end of the enterprise is looked after by Alvan Macauley. In the shop a lot of excellent manufacturing work is done, and there is a great deal of good toolmaking. No shop I have ever seen is more thoroughly systematized, yet without unnecessary complication and red tape. A large portion of their work is made of sheet steel and some exceptionally interesting punches and dies are to be seen here, which we shall probably be able to publish an account of later. The Burroughs adding machine was designed by its inventor to be constructed of various groups of mechanism, each group usually composed of a considerable number of parts being separately assembled and tested and then put in place to form the complete machine. This fact leads to a very interesting and complete system for keeping track of work and of shop costs. Each simple element is assigned a number which indicates the material of which it is made and each group of mechanism is assigned a compound or hyphenated number which shows of what smaller groups or pieces it is composed.

I noticed here a man doing a job of grinding at a very rapid rate. The piece was a small shaft 5 9-16 inches long over all and shouldered down at each end, leaving a central portion 5⅛ inches long to be ground. The stock is cold drawn mild steel, originally 5-16 inch diameter approximately, and after being shouldered down and a groove cut in one of the reduced ends for driving the piece in the grinder it is ground, removing about .005 inch and leaving .002 inch to come off. It is then hardened in cyanide and the grinding I saw being done was the finishing operation, to remove the remaining .002 inch after hardening. The wheel (a standard Brown & Sharpe grinder) ran over the piece once and back again without change in the adjustment of the cross-slide, and the man does them at the rate of 100 to 150 per hour.

The main frames of the machines are gray-iron castings, and they find it advantageous to do the japanning first thing after cleaning. They are then milled and the numerous holes drilled and counterbored in a jig which we have illustrated and described, and it is found that after a little experience the men handle them just as fast, without scratching or injuring the japanning and there is no japan to scrape off of the cut surfaces, while the joint between cut surfaces and japanned surfaces is better defined, cleaner and sharper. The japanning of course covers the surfaces to be cut, but Mr. MacCarthy says this makes no trouble and declares the practise of japanning first is in every way better than to do it last.

At this date, as I am about leaving for Chicago, there are still plenty of open trenches and excavations in Machinery Hall and much to be done before it is complete. Of course, a great deal has been done since the opening day, but there was more to be done than any visitor could form an idea of. A few exhibits are complete, a few more practically so, but a considerable proportion of these are covered most of the time (some of them all of the time) to protect them from dust and also because the number of visitors really interested in machinery or to whom it is worth

while to explain things is, so far, very small, and those in charge of exhibit spaces have a pretty lonesome time of it.

St. Louis, May 25. F. J. M.

Some New Things.

A NEW COIN PUNCHING PRESS.

The press here shown, technically called an automatic planchet cutting press, is used in mints for coin blanking. The general dimensions of the press are: Stroke, 1½ inches; distance between columns, 14 inches; flywheel, 36 inches by 5 inches; weight of flywheel, 750 pounds; speed, 100 to 150 strokes per minute. Tho as here shown it is intended to be driven by a belt, a 3 horse-power motor can be attached when desired. The most important special feature of this press is the swinging of the double rolls with their adjustable feeds and gages. Fig. 1 shows the front of the press with the rolls in working position, and Fig. 3 shows the rolls swung back out of the way. This is done without deranging any of the adjustments, and when the rear rolls also are swung back the press is perfectly accessible for setting, examining and adjusting the dies. The dies and punches in machines of this class must be changed frequently, often several times a day, which suggests the value of the above arrangement. Fig. 2 shows the rear of the press with a special scrap cutter outside the rolls. By means of this device the scrap may be cut into small pieces after each stroke of the press or it may be cut into pieces 3 to 6 inches long, the latter being generally preferred. This device may be swung out of the way either with the rolls or independently, the former being shown in Fig. 4 and the latter in Fig. 5. The cutting capacity of this press with its automatic feed is two blanks at a stroke of the dollar size, three of the half-dollar size, and four quarter dollars, nickels or pennies. This press is built by the E. W. Bliss Company, Brooklyn, N. Y.

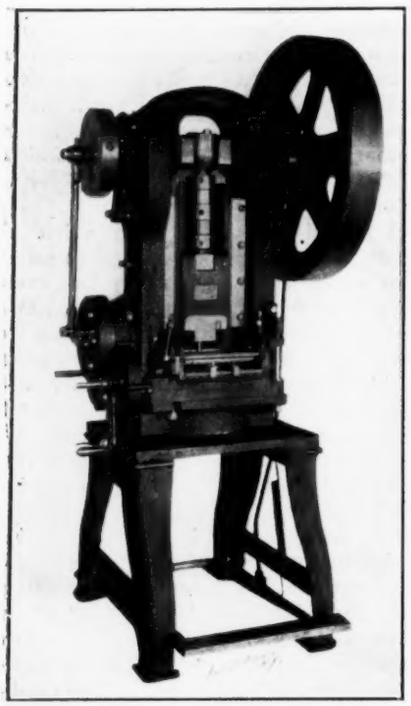


FIG. 1. FRONT OF AUTOMATIC PLANCHET CUTTING PRESS.

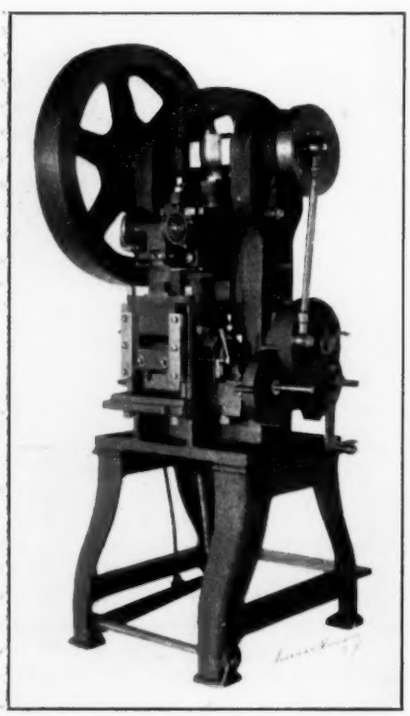


FIG. 2. BACK OF PRESS.

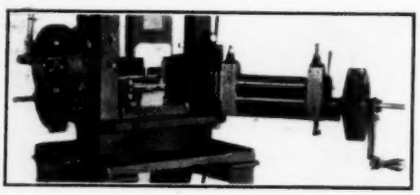


FIG. 3. FEED ROLLS SWUNG BACK.

A LOCOMOTIVE ROD MILLING MACHINE.

The half-tone shows a machine recently built by the Newton Machine Tool Works, Philadelphia, for milling side rods and connecting rods for locomotives. As will be understood from some of the dimensions, this is not a light or a little machine. The spindle, shown without a cutter, is 6 inches in diameter. It is driven through a phosphor bronze worm wheel and a hardened steel worm of steep pitch, these being entirely encased to secure profuse lubrication. The driving shaft has a four-step cone, not visible. It may of course be directly driven by a suitable electric motor. The crosshead is of a new design and is unusually heavy, and the spindle has an adjustment on it of 8 inches. The

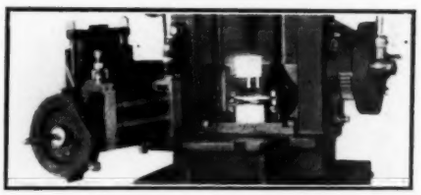


FIG. 4. REAR ROLLS SWUNG BACK.

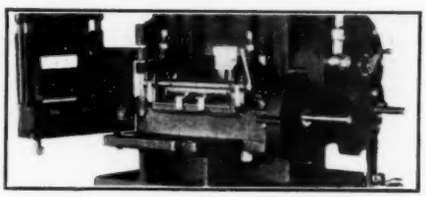
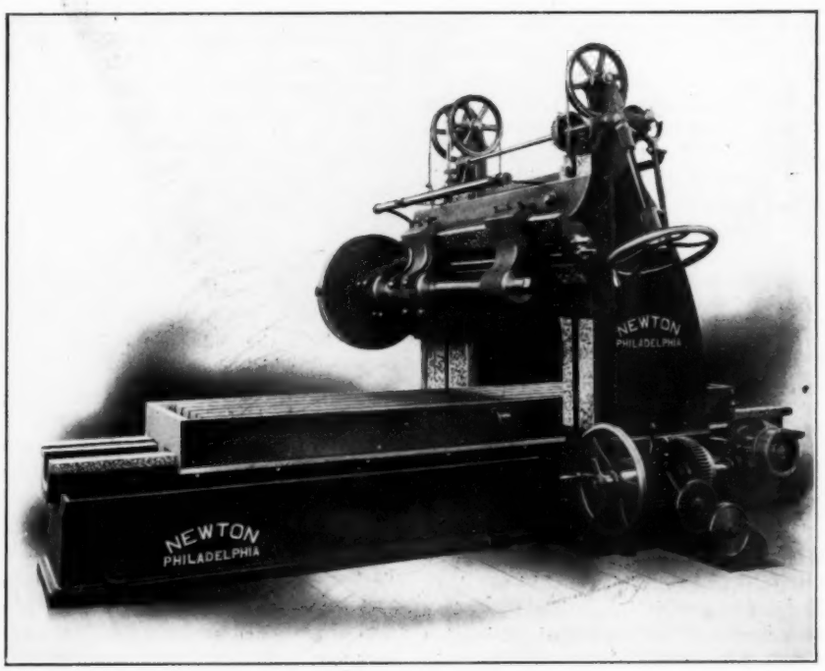


FIG. 5. SCRAP CUTTER SWUNG BACK.



LOCOMOTIVE ROD MILLING MACHINE.

outboard bearing also has an adjustment allowing for the lateral position of the cutters. The crosshead is counterweighted, has hand adjustment and power quick movement in either direction. The platen is 36 inches wide, to mill 12 feet in length, the space between the frames being 40 inches. A gutter is provided at the sides and a reservoir inside the bed for the lubricant used. The table movement is obtained by a helical pinion and rack, with a wide range of variable automatic friction disk feed and power quick traverse in both directions.

ADJUSTABLE TAP.

The body of this tap is tapered from front to rear to give ample chip room; and the grooves for the blades are milled at a 15-degree angle and run parallel to the taper surface. The blades fit tightly in their seats and are forced forward when requiring adjustment, the threaded collar at the rear forming the means by which the blades are properly reset. The Lapointe Machine Tool Company, 32 Atlantic avenue, Lewis Wharf, Boston, Mass., is the maker.

ADJUSTABLE TAP.

A NEW PIPE-THREADING MACHINE

The illustration Fig. 1 shows the entire machine, which has been designed to withstand the severe strains and rough usage these machines are usually subjected to, and as they are generally operated by unskilled labor, it is desirable to have the parts simple in construction, and all operations easy. There are two 3-jaw independent chucks, one at either end of the spindle, which have the faces of the jaw slides graduated so that it is easy to set them to any particular size pipe. The chucks are complete in themselves without any face-plates. The shells are single castings and consequently very stiff. The capacity of the machine is from 2½ to 8 inches, inclusive. Nine sets of dies are supplied with the machine, one set for each size. The machine has ten speeds, and is so designed that the correct cutting speed can be had for any size pipe within its capacity. These speeds are obtained through a gear box, Fig. 2, having five separate speeds, and a double clutch which throws between two trains of gears of different ratios; this clutch can be thrown in or out at any point. The gear case is oil tight and a little oil placed in the bottom of it will keep the gears lubricated for a long time. The cam ring, Fig. 3, is of cast iron, in which the interchangeable hardened steel cams are secured by means of dovetail keys drawn into place by filister head machine screws inserted from the outside of ring. The adjusting mechanism is by means of a hand nut on the adjusting screw, on the side of the machine directly

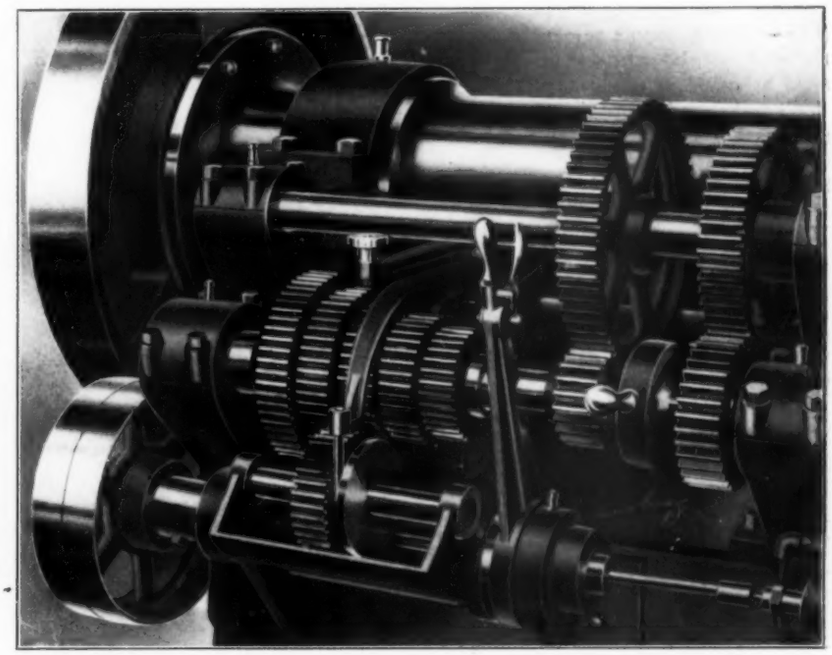


FIG. 2. A NEW PIPE-THREADING MACHINE.

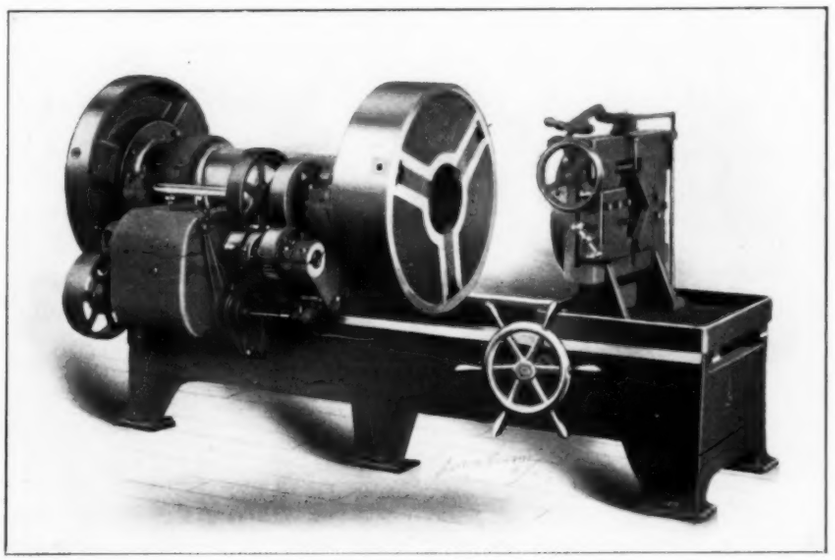


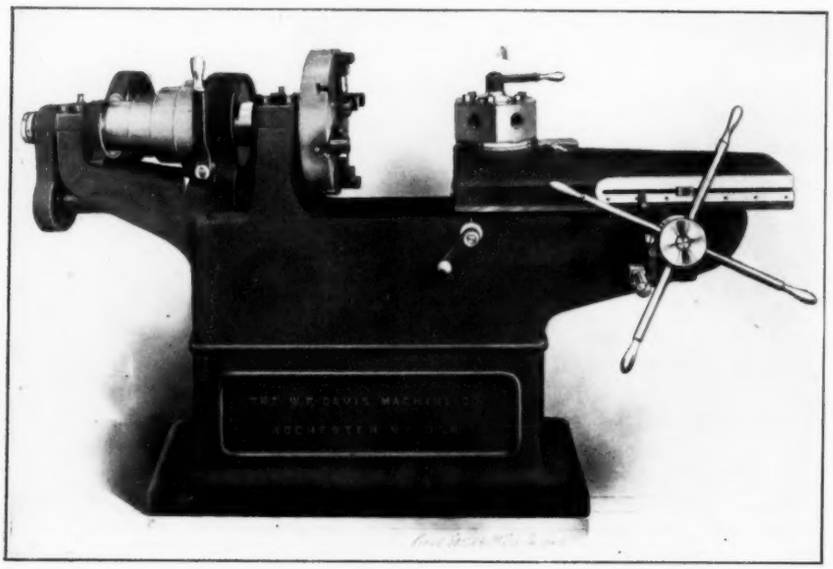
FIG. 1. A NEW PIPE-THREADING MACHINE.

FIG. 3. CAM RING AND CUTTER FOR PIPE DIE.

in front of the operator. The chasers used, one of which is shown in the center of cam ring, Fig. 3, are made of a single piece of steel. The chasers are made on a special machine and any one of them can be replaced without regard to the balance of the set. A rotary pump is supplied with the machine. The machines are made in three sizes—No. 4, capacity 1 to 4 inches; No. 8, capacity 2½ to 8 inches; No. 12, capacity 4 to 12 inches. They are made by the Stoever Foundry & Manufacturing Company, Myerstown, Pa.

FRICTION HEAD TURRET BORING LATHE.

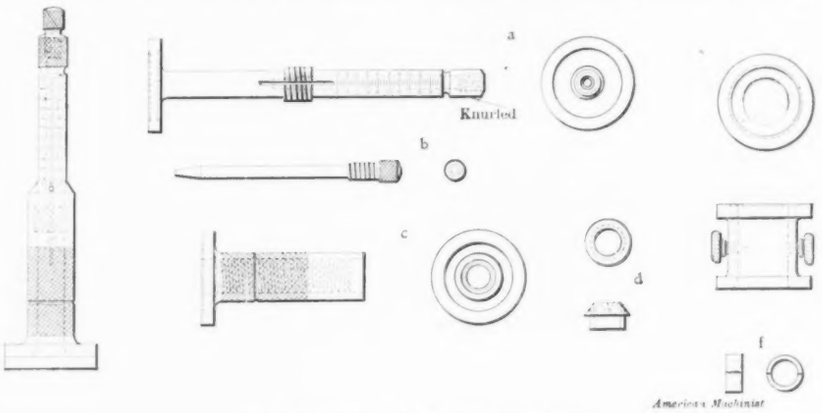
The half-tone shows a new turret boring lathe for which extensive employment should be found in the average shop. It is built to be used for boring exclusively, and embodies special features not found in the usual boring lathe. The lathe has a friction head which, with two different speeds on the countershaft, gives sixteen speeds for the spindle. There is a wide range of feeds and changes may be made without stopping. There is an automatic stop for the feed. The turret, in addition to the holes for the tools, is accurately trued on its faces so that special forming tools can be used. The swing of the lathe is 24 inches. It is provided with a center rest or tool rest, not shown, which supports the tool close to the cut. Built by the W. P. Davis Machine Company, Rochester, N. Y.



FRICTION HEAD TURRET BORING LATHE.

A NEW SLOT AND RIB MICROMETER.

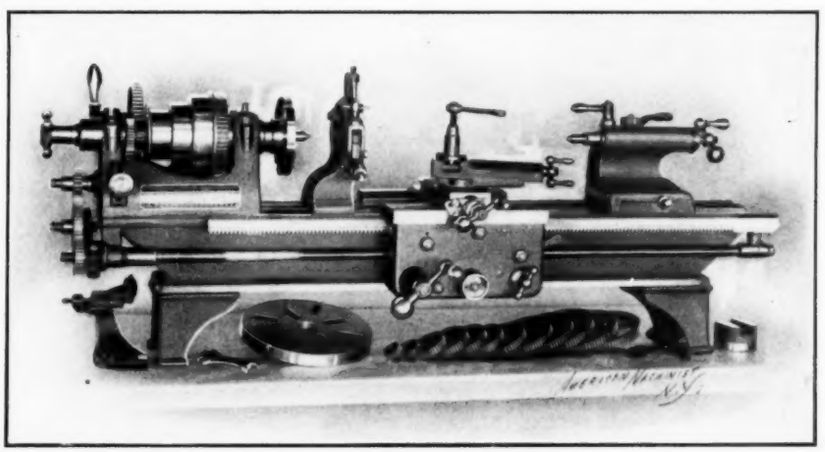
The illustration shows a disk micrometer which is useful for either inside or outside measurements and can also be used as a hight gage. The stem *a* is threaded outside for a short distance, as shown, 40 threads per inch; it is then bored out parallel for a certain distance and then taper bored under the externally threaded portion which is then slotted through as shown; the small end of *a* is knurled on the outside and threaded internally to receive the taper-pointed plug *b* which, when screwed in, expands the threaded and slotted part of *a*, binding it in the barrel *c*. The graduated thimble end *d* is forced in end of sleeve *c*. The broken bushing *f* is notched on both sides, hardened and ground, then broken and placed in disk end of sleeve *c* after stem *a* has been assembled in *c*, acting as a guide to steady stem *a*. The spool-shaped sleeve *e* when placed over sleeve *c* and held in position by two small set-screws increases the capacity of the tool for inside measurements. This instrument has been patented by George J. Lavigne, 546 East Main street, New Haven, Conn.



A NEW SLOT AND RIB MICROMETER.

A NEW SCREW-CUTTING BENCH LATHE.

The lathe here shown, swinging 10 inches over the bed and 24 inches between centers, is built in recognition of an extensive and growing demand for an accurate and reliable screw-cutting bench lathe for laboratory, electrical, optical, experimental, tool, model and other small work. The headstock has a large crucible steel forged spindle with draw-in chuck for split collets up to ½ inch, phosphor-bronze boxes with end-thrust ball bearings. A push-pin on the large gear allows the cone to be locked or unlocked without the use of a wrench. The cut-under tailstock allows the compound rest to swing around parallel with the ways, with room to operate the feed-screw handle. The tail spindle has an improved locking device, the bearing of the tailstock on the bed is long and the locking device renders it firm and rigid. The carriage has a long bearing on the ways, and is gibbed both front and back with a cam-locking device when the cross feed is used. Plain and compound rests are regularly furnished and easily interchange. The base of the

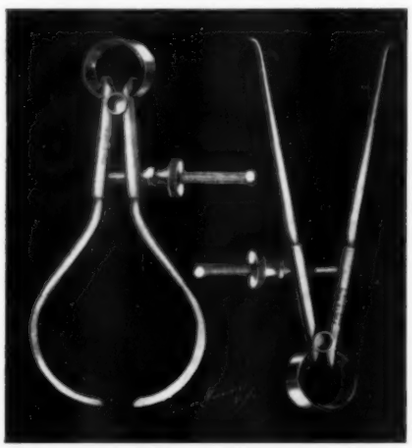


A NEW SCREW-CUTTING BENCH LATHE.

compound rest is graduated 180 degrees, and the crossfeed screw to thousandths of an inch. European tool-post can be furnished in place of the regular. The range of feeds—cross or longitudinal—is large, and for screw cutting includes all the standard threads. The thread of the lead screw is only used for screw cutting. Special arrangements are provided for interchangeably cutting metrical threads, or a metrical screw can be supplied. The bed is strong and well braced. The countershaft has friction clutch pulleys, self-alining, self-oiling bearings. A large stock of attachments is furnished with the lathe. The lathe is designated the "Star Special" and is made by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y.

NEW SPRING CALIPERS AND DIVIDERS.

The beautiful tools here shown, just put out by the Brown & Sharpe Manufacturing Company, require not a word of com-



NEW SPRING CALIPERS.

mendation or explanation from us. Dividers are made similar to the inside calipers. There are three sizes—2, 3 and 4 inches.

A NEW METHOD OF MAKING FLOAT BALLS FOR WASH-DOWN CLOSETS.

The Toledo Machine & Tool Company, of Toledo, Ohio, have recently devised a new method of forming float balls for wash-down closets. The balls, instead of being spun into shape, are made complete with dies on a Toledo open-back inclinable geared press. Each half of the ball is drawn in two operations and the outside edges are afterward trimmed and folded. The two halves are then clamped together by means of a closing die. In this closing die, an ingenious device is used which closes the halves of the ball so tightly together that very little solder is necessary to make the ball air-tight. The floats are produced in a neater and smoother manner by this method than by spinning them into shape, and are produced at from 50 to 60 per cent. less labor cost.

The address of the C. Weidlog Manufacturing Company, manufacturer of the machine slide traverse indicator shown in the preceding issue, is 7 Fulton street, *Brooklyn*, instead of New York, as printed.

The Westinghouse Electric Works and Work.

The Westinghouse Electric & Manufacturing Company has recently issued a publication which is out of the line of the usual trade catalog. The work referred to, 9½ by 7½ inches by ¼ inch, is artistically designed, lavishly illustrated and beautifully printed, and is not unworthy of the great works which it represents. It tells briefly of the birth and growth of the works, and gives an account of their present condition and magnitude. Some account also is given, with suitable illustrations, of the most notable work which this company has done. Among the great undertakings was the electrical equipment of the Manhattan Elevated Railway and of the Rapid Transit Subway. That of the South Side Elevated of Chicago also is mentioned and the Niagara Falls installations, while the equipment for the St. Louis fair is not overlooked. The arrangements for the comfort, education and stimulation of those connected with the works are presented in a specially interesting way.

Technical Publications.

"Table of Gage Numbers with Decimal and Nearest Fractional Equivalents." Winn, Milmore & Porter, Chicago, Ill.

This table is printed on cardboard and is suitable for hanging on the drawing-office walls. It gives the values of the numbers of ten different gages and a supplementary table gives the materials for which the various gages are used. The table is of obvious utility and will be forwarded to any address upon receipt of postage. The street address of the publishers is 108 La Salle street.

"Up to Date New York Air Brake Catechism." By R. H. Blackall. 254 5x7-inch pages, with 75 illustrations. The Norman W. Henley Publishing Company, New York. Price, $1.25.

The perfection and the intricacy of railroad braking apparatus is nowhere better shown than in the books which it has called into existence. The present volume describes the apparatus of the New York brake very completely and includes accounts of the various troubles experienced in the operation of the brakes, together with the detection of their causes. The book is in the question-and-answer style.

"Twentieth Century Hand Book for Engineers and Electricians." By C. F. Swingle, H. C. Horstmann and V. H. Tousley. 207 4½x6½-inch pages, with 110 illustrations. Frederick J. Drake & Co., Chicago. Price, $2.50.

This is an operative engineer's power-plant hand-book written partially in the question-and-answer style. It discusses boiler settings, operation and appurtenances, combustion, evaporation tests, valves and valve setting, the indicator and its use and the essentials of electricity. The electrical section especially is extremely clear and well written. It explains the principles of dynamo action, the principles of circuit layouts and connections and the action of various station instruments.

The Derry-Collard Company has sent us a sample pad of their new isometric sketching paper which should do much to increase the use of this most useful system of making drawings. The paper is similar to the squared paper so largely used by many for shop sketches except that the light lines are ruled at the isometric angle. By the use of the paper all straight lines are laid down without the use of any instrument except a ruler and pencil, while the directions of the long and short axes of ellipses are also indicated. The paper should also be highly useful in plotting observations and data on the three co-ordinate system for which it is better adapted than squared paper, and it may do much to popularize this method of plotting observations and data. The paper is made in three sizes—6x9, 9x12 and 12x18 inches—the price per pad of 50 sheets being 25 and 50 cents and $1.00, respectively.

Personal.

E. M. Griffiths, of C. W. Burton, Griffiths & Co., London, is at the Manhattan Hotel, this city, on his way to the St. Louis Exposition.

Chas. R. Hewitt, long familiar with the pneumatic tool trade, is to be connected with the Rand Drill Company, 128 Broadway, New York, giving special attention to the "Imperial" tools.

John B. Allan, formerly vice-president and general manager of the Allis-Chalmers Company, is to become Western manager of the Westinghouse Machine Company, with headquarters at 171 LaSalle street, Chicago. Mr. Allan has been prominently associated with the Allis-Chalmers Company for twenty-four years, filling positions of progressively increasing importance, including those of sales manager, general manager and vice-president.

Edwin T. James, master mechanic of the Lehigh Valley shops at Buffalo, has been promoted to shop superintendent of the extensive new shops at Sayre, Pa. Mr. James was first employed by the company in 1876 as a machinist at Easton; in 1889 he was made engine-house foreman at the same place, being transferred to Lehighton in 1895. In 1899 he was appointed general foreman at Wilkesbarre and a month later became master mechanic, being transferred to Buffalo in 1902.

Arthur West, formerly engineer with the Allis-Chalmers Company, is to become chief engineer of the Westinghouse Machine Company, with headquarters at East Pittsburg. Mr. West, after a technical course at the University of Wisconsin, entered the

employment of the Edward P. Allis Company as a machinist and became successively erecting engineer, assistant to shop superintendent, assistant superintendent, private engineer for Edwin Reynolds in his special work, general trouble engineer on all steam engine work, salesman in pump department, engineer of tests, manager of pump department and assistant chief engineer.

Obituary.

Thomas Murphy, proprietor of the Murphy Iron Works, Detroit, died at Phoenix, Ariz., May 22, sixty-nine years old.

Charles Parkin, retired steel manufacturer of Pittsburg, died May 27, sixty-six years old. Mr. Parkin was a pioneer of the crucible steel industry of Pittsburg. He was a native of Sheffield, England, and learned all the details of steel manufacture there before coming to this country.

Manufacturers.

The planing mill of J. & J. Kerr, Petrolia, Ont., has been burned.

The plant of the Ponca Ice Company, Ponca City, Okla., has been burned.

Joseph Sawyer is building an iron foundry at Oswego, N. Y., 35x100 feet.

The mattress factory of Frank Lindsay, Portsmouth, Va., has been burned.

The Missisquoi Pulp Company, Sheldon Springs, Vt., will build a mill shortly.

The McCaskey Register Company, Alliance, O., is erecting a new factory building.

The H. D. Williams Cooperage Company, Poplar Bluff, Mo., will enlarge its plant.

The Nolde & Horst Company, Reading, Pa., will make an addition to its hosiery mills.

D. Ackland & Son, manufacturers of carriage woodwork, Winnipeg, Man., are to build a new factory.

A 60x70-foot foundry addition is planned for the Deoxidized Bronze & Metal Company, Bridgeport, Conn.

The Chicago, Cincinnati & Louisville road is said to be planning for a wood-working shop at Peru, Ind.

Fire has destroyed the Los Angeles, Cal., branch packing-house of the Cudahy Packing Company, Chicago, Ill.

Application has been made for a charter for the Lehighton (Pa.) Lace Company, which will erect a plant.

The shingle mill at New Westminster, B. C., of Thos. Kirkpatrick, of Vancouver and elsewhere, has been burned.

The Oakland (Cal.) Transit Company plans establishing a car repairing and manufacturing plant at Emeryville.

The Stony Brook Plant of the United Boxboard & Paper Company, at Whippany, N. J., has been badly damaged by fire.

Saw and planing mills of the Buffalo (N. Y.) Yellow Pine Company, at Haylow, Ga., have been in great part burned.

W. G. Lynch, of Minneapolis, Minn., has been in Fairbault, Minn., arranging to establish a factory to make beds and sofas.

The Mesta Machine Company, Pittsburg, Pa., has started work for extensive improvements to its plant in West Homestead.

The plant of the Hoffmann Manufacturing Company, maker of bar fixtures and furniture, Detroit, Mich., has been damaged by fire.

The corner stone for the new plant of the Ferracute Machine Company, Bridgeton, N. J., has been laid and the buildings are rapidly going up.

A seven-story, 75x135-foot building is being planned for at Cincinnati, O., to be occupied by Merkel Bros., plumbers' and steam and gas fitters' supplies.

It is said that the Cincinnati, Dayton & Toledo traction company is thinking of building a large power station to replace a number of smaller ones.

The Brady Cement Stone Machine Company, Jackson, Mich., is about to build a machine shop and office building, and perhaps will erect a foundry.

The Geo. Delker Company, manufacturer of carriages, Henderson, Ky., proposes to fit up a recently purchased factory at that place for its line of work.

The Farmers' Manufacturing Company, Norfolk, Va., has bought timber at Eure, N. C., and will erect a plant for the manufacture of truck packages.

The Eagle Manufacturing Company, Appleton, Wis., manufacturer of portable gas engines and implements, proposes to erect a new 200x200-foot building.

Winfield S. Schuster, of W. E. Hayward & Co., East Douglass, Mass., and others have bought property with water-power, where they propose to build a new yarn mill.

The Business Men's Association, Bloomington, Ill., is in touch with an Indianapolis manufacturing enterprise which, if secured for Bloomington, will employ 1,500 men.

The Metropolitan Redwood Lumber Company, organized by men of Menominee, Mich., or vicinity, has bought a tract of timber in Humboldt County, California, and will build a mill plant.

W. F. Taubel, who has a plant at Riverside, N. J., and elsewhere, has purchased ground at Tamaqua, Pa., upon which he will erect a knitting mill and furnish employment to about 300 hands.

The James Reilly Repair & Supply Company, New York city, has taken out a charter with a capitalization of $1,000,000, and proposes to enlarge its Jersey City shops for the repair of machinery, etc.

The Carthage (Mo.) Cotton Mills have been formed and may build a mill at Carthage, Mo., this summer. It is reported that Witten McDonald, of Kansas City, is taking a prominent part in the management.

The Keokuk Improvement Company is working on a plan to get four eastern factories to merge and locate in Keokuk, Ia. One is an automobile factory, another cutlery, another tools and the fourth woodenware.

Huron, O., is trying to secure a concern which is to manufacture the Mayor, Junior, patent life boat, employing perhaps 200 men. Among the contributors to the project are Christ Ray, T. R. Gilmore and C. Z. Montague.

The construction of a sugar factory near the Bay of Nipe, Northeast Cuba, is under consideration by American capitalists. Interests identified with the United Fruit Company, Boston, Mass., are said to be concerned.

A couple of big plants will be erected in Atlanta, Ga. One is a cold-storage plant, to be erected by J. S. Stephens & Co., of Cincinnati. The other is a cotton seed oil mill and factory, to be erected by the Buckeye Cotton Oil Company.

The Harry Bros. Company, Dallas, Tex., manufacturer of galvanized steel water tanks, has bought a tract of land near New Orleans, La., where it will have a plant either for manufacturing or perhaps for distributing purposes only.

Burger Bros., Manitowoc, Wis., is a newly formed company which has taken over the business of Henry Burger, Jr., conducting a shipyard. The company will enlarge the plant and add new machinery. It will build steam yachts and lake craft.

In the presence of 1,500 people the corner stone was laid, May 21, for the shops of the Farmers' Co-operative Farm Machinery & Implement Company, Springfield, O., mentioned in our No. 17. There will be many buildings, the main one being 250x50 feet.

The city council, Stratford, Ont., has received a proposition looking to the establishment of a factory there by W. H. Crowe and F. A. Nichols, who have been connected with a concern at Superior, Wis. Geo. McLagan, of Stratford, is in touch with them.

The Philadelphia & Reading road has bought land at Newberry (Williamsport), Pa., where it is expected a car-repairing shop, about 80x400 feet, will be built, to be equipped with appliances, including an air-compressing plant for pneumatic tools, etc.

The approaching season of patriotism has been celebrated in anticipation by two fireworks factory explosions, each of them filling a creditable list of dead and wounded. One was at the Lake Shore Novelty Company's plant, Findlay, O.; the other at the plant of Jose Scalone, near Camden, N. J.

John C. Barber, president of the Standard Car Truck Company, Chicago, is quoted as saying that he is testing a perfected truck and that when this is finished, which he believes will be within a year, he will build a $500,000 plant for the construction of the same. The location may be Milwaukee.

The American Construction Company (office in the Tinsman block), Williamsport, Pa., proposes to build a large plant for the manufacture of appliances for the maximum contact system in electrical traction. G. L. Campbell is president. A leading article of manufacture will be a vitrified block of some sort.

The United States Furnace & Foundry Company, organized with a West Virginia charter by Charles Bradley, of Pittsburg, has decided to locate its plant at New Kensington, Pa. It has bought the Bradley stove foundry, which was absorbed by the Pittsburg Stove & Range Company and abandoned, and will put it in shape. Fifty men will be employed at the start.

New Catalogs.

Veeder Manufacturing Company, Hartford, Conn. Veeder form "C" tachometer. Illustrated folder.

Termaat & Monahan, Oshkosh, Wis. Two-cycle gasoline marine engines. Illustrated. 5x7, pp. 12, paper.

W. D. Mohn & Co., Reading, Pa. Illustrated circular of the "Little Giant" steel shear and rod cutter.

Toronto (Ohio) Machine Company. Descriptive booklet of the "Paragon" tool holder. 3½x6, pp. 12, paper.

Coes Wrench Company, Worcester, Mass. Illustrated catalog of knife-handle and steel handle wrenches. 9x12, paper.

Buffalo Forge Company, Buffalo, N. Y. Eight-page pamphlet illustrating Buffalo hand blowers. 3½x6½, paper.

Keystone Drill Company, Franklin, Pa. "Keystone-Schumucker" rock drills and air compressor. 6x9, pp. 20, paper.

Lucas Machine Tool Company, Cleveland, Ohio. Descriptive circular of the Lucas power forcing press. Illustrated.

American Blower Company, Detroit, Mich. Illustrated miniature catalog of "A. B. C." disk fans. 3½x4½, pp. 16, paper.

Yale & Towne Manufacturing Company, 9-13 Murray street, New York. Folder illustrating Yale & Towne chain blocks.

Blaisdell Machinery Company, Bradford, Pa. Blaisdell air compressors, illustrated and described. 6x9, pp. 10, paper.

Hart-Parr Company, Charles City, Iowa. Gasoline engines, stationary, portable and traction. Illustrated. 6x9, pp. 29, paper.

Miller Gauge Saw & Trimmer Company, Denver, Colo. Illustrated folder describing the Miller universal gage saw and trimmer.

August Mietz, 128 Mott street, New York. Catalog No. A33 of Mietz & Weiss gas and oil engines. Illustrated. 6x9, pp. 21, paper.

Pawling & Harnischfeger, Milwaukee, Wis. Horizontal drilling and boring machines. Illustrated and described. 6x9, pp. 16, paper.

American Tap & Die Company, Greenfield, Mass. No. 1 catalog and price list of taps and dies. Illustrated. 3½x6, pp. 16, paper.

Lucas Machine Tool Company, Cleveland, Ohio. Booklet descriptive of the Lucas "Precision" boring, drilling and milling machine.

O. S. Walker & Co., Worcester, Mass. Walker magnetic chucks and surface grinders. Illustrated. Catalog "F." 6x9, pp. 30, paper.

Emerson Electric Manufacturing Company, St. Louis, Mo. Illustrated catalog of electric fans and fan motors. 3½x6, pp. 16, paper.

John Lang & Sons, Johnstone (near Glasgow), Scotland. Lang's patent variable-speed lathes. Illustrated. 5x9, pp. 12, paper.

Schellenbach & Radcliffe, Cincinnati, Ohio. Catalog and price list of universal adjustable reamers and tools. Illustrated. 4x6, pp. 12, paper.

Joseph Dixon Crucible Company, Jersey City, N. J. Booklet descriptive of Dixon's graphite pipe joint compound. 3¼x6, pp. 11, paper.

Marvin Electric Drill Company, Binghamton, N. Y. Marvin electric rock drills and generators. Catalog No. 4. Illustrated. 6x9, pp. 31, paper.

The Arnold-Creager Company, New London, Ohio. Brick-making machinery and brick makers' supplies. Illustrated. 7¼x10¼, pp. 56, paper.

Diamond Machine Company, Providence, R. I. Gorton disk grinders, fully described and illustrated by half-tones and drawings. 6x9, pp. 94, paper.

Wyman & Gordon, Worcester, Mass. "A Short Story of Thomas Newcomen," one of a series of brief and instructive biographies published by this company.

Sprague Electric Company, New York. Lundell fans, ceiling, desk and exhaust, and Lundell fan motors. Catalog No. 308, illustrated. 7x9½, pp. 20, paper.

E. W. Bliss Company, Brooklyn, N. Y. "Power Presses; a Treatise," wherein are illustrated a number of types and sizes of Bliss presses. 5x7½, pp. 50, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Circular No. 73, illustrating conveying systems, screens, drills, chain and other Jeffrey products. 3½x6, pp. 28, paper.

Cincinnati Shaper Company, Cincinnati, Ohio. Catalog "C" of shapers, including standard crank shapers, rack shapers, traverse shapers, etc. Illustrated. 6x9, pp. 47, paper.

Millers Falls Company, Millers Falls, Mass. Pocket catalog and price list of braces, drills, hacksaws and other tools and machines made by this company. Illustrated. 3½x5½, pp. 78, paper.

S. W. Card Manufacturing Company, Mansfield, Mass. 1904 catalog and price list of Card taps, dies, screw plates, reamers, etc. Illustrated by half-tone cuts. 4¾x7½, pp. 97, paper.

Keystone Electric Company, Erie, Pa. Catalog illustrating the lines of generators, motors and switchboards made by this company, including a number of views of motor-driven machines.

Bickford Drill & Tool Company, Cincinnati, Ohio. "Bouquets" is the title of a neatly bound collection of reproduced letters, from well-known manufacturers, to the above company, testifying to the merits of the new Bickford radial drill.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 45, describing and illustrating the Crocker-Wheeler electric equipment for driving the presses and other machinery at the Government printing office, Washington, D. C. 7½x10, pp. 16, paper.

Warner Instrument Company, Beloit, Wis. Catalog or treatise on the cut-meter, an instrument for indicating the cutting speed of tools. Full-page illustrations show applications of the cut-meter to various kinds of machine tools. 6x9, pp. 25, paper.

Webster & Perks Tool Company, Springfield, Ohio. Solid-die automatic bolt-threading machines, shown with single, two, four and six spindles. Illustrated. 6x9, pp. 15, paper. Also illustrated catalog of grinding and polishing machinery. 6x9, pp. 10, paper.

National Automatic Tool Company, Dayton, Ohio. Illustrating and describing Nutting's full automatic universal multiple spindle drill press, automatic multiple drilling machine for sewing machine arms, and rotary platen automatic multiple drill. 8x10½, pp. 22, paper.

Hussey Drop Forge & Manufacturing Company, Cleveland, Ohio. Catalog showing some of the products of this company, including slide and tilting steering wheels, radiators, circulating pumps, grease cups, lubricators, drop forgings, etc. Illustrated. 3¼x6½, paper.

The Garvin Machine Company, Spring and Varick streets, New York. Illustrated catalog of machine tools, including milling machines, screw machines, monitor lathes, chucking lathes, tapping machines, drill presses, cutter grinders, etc. The catalog is appended with a number of pages containing engineering data and tables. 4x6, pp. 210, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wire and sheet metal working machinery and tools. Emmons Collins, Chicago.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Working drawings, tracings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Wanted—Small article to manufacture; correspondence solicited. Box 1232, Springfield, Mass.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—A second-hand 30 in. full automatic gear cutter, in A1 condition. Address "Jute," care AMERICAN MACHINIST.

Unusual facilities for accurate work, dies, tools and special machinery. Wiebking, Hardinge & Co., 1227 Newport ave., Chicago.

Wanted—Machinery or machine parts to build by contract or day work; good facilities; charges reasonable. Address A., care AMERICAN MACHINIST.

Agents wanted in all parts of the country to introduce a new tool, on liberal commission. Address Crane & Richardson, 112 Water st., Boston, Mass.

A director of methods for increasing machine shop production solicits transient engagements; $300 per month; vast experience; excellent record; incomparable ability. Box 14, AMERICAN MACHINIST.

"Railroad Pointers"—A handy vest-pocket booklet about tractive power, grades, curves, types of locomotives, cars, air brakes, etc., etc.; 10c., coin or stamps. The Derry-Collard Co., 257 Broadway, New York.

Wanted—To build, by day labor or contract, medium weight or heavy machines or parts for machines; ideas developed and machines built; our plant is new and up to date; 36 years' experience. Address M., care AMERICAN MACHINIST.

Business opening for a good mechanic; small but established business, manufacturing machine tools; situated near New York; about one-fourth interest can be obtained for $2,000; full investigation. Address Box 1, AMERICAN MACHINIST.

We are in position to furnish drawings of jig fixtures, work holders and necessary tools for the rapid and economical machining of steam pump castings (especially duplex). We are experts; let us know your wants; charges moderate. Address Beck, care AMER. MACH.

Wanted—In every machine shop, foundry and pattern shop of the United States and Canada, an energetic, reliable man to take the agency for a newly invented article, indispensable for every shop hand; big seller; large commission; something entirely new; write to-day for particulars; state the name of the firm you are working for and mention this paper. Fluid Specialty Co., Reading, Pa.

For Sale.

For Sale—The first twenty volumes of the AMERICAN MACHINIST, bound and in perfect condition. A. H. Brainard, Hyde Park, Mass.

Transmission Gear and Differential Patents.—Strong points are efficiency, simplicity, accessibility and cheapness; three forward speeds and reverse; not planetary. Box 2, AMERICAN MACHINIST.

Manufacturer, capitalist or town seeking industry can learn of first-class typewriter, with complete plant for manufacturing, ready for instant production, that can be taken over at once. J. S. Freeman, care AMER. MACH.

For Sale—Best established mill and mining machinery business in Pacific Northwest; shows good average yearly profits in the past and can be materially improved; will require investment of $75,000 to $100,000. Address Lock Box 517, Portland, Ore.

For Sale—An old-established pattern shop; excellent reputation; centrally located in New York city; equipped with up-to-date woodworking machinery; splendid opportunity for energetic party; selling because another line requires more attention. Address "Patterns," care AMERICAN MACHINIST.

New Turbine.—The American patent for a new turbine exceeding anything already known in regard to mechanical power (33⅓ per cent. utilization of fuel), is for sale, or participation in a German syndicate is sought for the same. Please address offers to X., 3378 Poste Restante, Berlin, Charlottenburg, II, Germany.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

ILLINOIS.

Educated, skilled machine shop and foun-

dry superintendent; 30 years' experience general and special machinery; best references; now open. Address Y., 6458 Eggleston ave., Chicago.

INDIANA.

Superintendent or foreman open for engagement; experienced in special machine tools, large and small electrical machinery; good systematic and executive ability; up to date in modern methods; A1 references; age 30. Box 7, AMERICAN MACHINIST.

MASSACHUSETTS.

Draftsman; 15 years' experience as machinist and toolmaker; inventive ability. Box 529, AMERICAN MACHINIST.

MICHIGAN.

Superintendent, New England man, age 38, smart, educated, good executive ability, wishes change; good inventor; up in modern practice; best references. Box 13, AM. M.

NEW JERSEY.

First-class patternmaker wishes situation. Address Box 480, AMERICAN MACHINIST.

Master mechanic, of 15 years' experience, desires position. G., care AMER. MACHINIST.

NEW YORK.

Competent mechanical superintendent desires change; A1 references. Box 15, AM. M.

Position in salesroom or stockroom by reliable young man; object, experience. Box 12, AMERICAN MACHINIST.

Mechanical and electrical draftsman, technical education, 5 years' experience shop and drafting room, desires position. Box 519, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, desires position; 8 years' experience, machinery, automobiles, engines; references. Address Box 8, AMERICAN MACHINIST.

Mechanical engineer, 5 years' experience in designing hoisting machines and general machine work, good draftsman, wants position; best of references. Box 5, AMER. MACH.

Position as superintendent or assistant superintendent; practical training as machinist; technical training as draftsman and designer; present position superintendent and designer. Box 6, AMERICAN MACHINIST.

OHIO.

All-round mechanic and designer, 12 years' executive experience in shop and office, wants position; dies, special tools, gas engines or general machinery. Box 524, AMER. MACH.

PENNSYLVANIA.

Wanted—Position as superintendent or works manager on small or medium class of good work, by young man, now satisfactorily filling such a position, but who, for good reasons, wishes to make a change; best references. Address Box 501, AMER. MACHINIST.

Want position as superintendent of small plant with growing possibilities; am good judge of men, executive, systematizer, expert cost reducer; can make your shop pay better; willing to work on small salary and percentage based on above. Do you need such a man? M. F., Box 56, Harrisburg, Pa.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Mechanical engineer and practical machinist, thoroughly competent to act as superintendent. Apply Box 526, AM. MACH.

Wanted—Toolmakers; give experience and wages expected; none but first-class men wanted; permanent position to right men. Ross Rifle Co., Quebec, Canada.

Wanted—A thoroughly practical foundry foreman, capable of taking entire charge of a modern, up-to-date foundry; electrical and mining machinery; letters of applicants must contain references. Box 11, AMER. MACH.

MASSACHUSETTS.

Wanted—All-round gear cutting man; one used to Fellows gear shaper preferred. Address Boston Gear Works, Boston, Mass.

MICHIGAN.

Wanted—Technical graduate with experience in machine tool work, for instructor in machine design and drawing in a large engineering school in the Middle West. Box 536, AMERICAN MACHINIST.

NEW JERSEY.

A young draftsman who can make working drawings from rough draft, and who has had at least 1 year's experience in modern drafting department; wages $12; state experience. Address C. A. Thomson Machine Company, 345 Main st., Belleville, N. J.

NEW YORK.

Wanted—Three or four first-class experimental mechanics on telephone work. Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.

WANTED.—20 toolmakers. Wages 36 cents to 43½ cents per hour. Competent men with good records may apply to Civil Service Examining Board, Watervliet Arsenal, Watervliet, N. Y., for application blanks.

Wanted—Several A1 mechanical draftsmen; give full particulars as to previous employment, enclose references and state salary expected. Address Engineer in Charge, Drafting Department, General Electric Co., Schenectady, N. Y.

Wanted—A practical, experienced mechanic and manager of men and work, both foundry and machine shop; must be capable of handling 200-500 men and produce results; permanent position and an opportunity for a working interest; state your experiences in full, kind of positions, length of time and their responsibilities; age, references and salary wanted. Buffalo Steam Pump Co., Buffalo.

OHIO.

Wanted—First-class man as speed boss, also to set rates, Taylor system; good position for right man; references required. Box 10, AMERICAN MACHINIST.

Wanted—Draftsman, technical graduate, experienced in machine tool design and in up-to-date drawing room and shop practice; good position; references required. Box 9, AMERICAN MACHINIST.

PENNSYLVANIA.

Concern in eastern Pennsylvania has room for five or six good machinists. For further particulars address "Accurate," Box 3, A. M.

Wanted—A first-class toolmaker as foreman of small tool room in brass department; state age and experience. Address The Kelly & Jones Co., Greensburg, Pa.

Wanted—Foreman in a shop manufacturing the highest grade of electrical measuring instruments, in considerable variety; would have charge of about 25 employees; should be experienced in handling men, energetic, of good executive ability, with a high standard of workmanship, and able to turn out work at low cost; excellent position with a rapidly growing business for right man; state fully qualifications. Box 4, AMER. MACHINIST.

The Monotype Company maintains a school to train young men to meet the constantly increasing demand for operators of its type casting and composing machine. These operators have done so well that it receives more applications for places than can be filled. In making selections these qualifications carry most weight: common sense, type foundry experience, printing office experience, automatic machinery experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. The Lanston Monotype Machine Co., 1231 Callowhill st., Philadelphia, Pa.

WEST OF MISSISSIPPI.

Three first-class machinists; general hands; one must thoroughly understand operation of roll grinding and corrugating machines; steady work; "open shop." Address Box 488, AMERICAN MACHINIST.

WISCONSIN.

A man to take charge of the plant repairs and construction in works engaged in general manufacture, employing 750 men; machine shop, plate shop, blacksmith shop and foundry. Box 525, AMERICAN MACHINIST.

Machinists—A firm in Wisconsin has room for a few first-class machinists on vise work, erecting floor or machine tools; steady work to men proving satisfactory; write, giving experience in full and other particulars. "Wisconsin," care AMERICAN MACHINIST.

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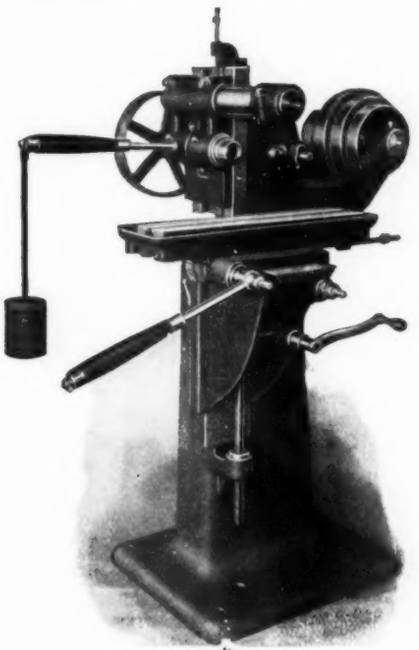

A Tip-Top Milling Machine

New No. 6 Manufacturer's Hand & Weight (feed) Milling Machine with Pillar Column & Overhanging Arm

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The Whitney Mfg. Co., Hartford, Conn.

DEAR SIRS: As soon as your Hand Milling Machine was received, we set it to work cutting key-seats for your System of Keying, and we are pleased to say that so far it has given perfect satisfaction. We note one job in particular where one of our men cut as many key-seats in four hours as could be done in the old way in 2½ days. The only thing we have to regret is that we did not adopt your System of Keying several years ago.

Yours very truly,

THE SENECA FALLS MFG. CO.

It cuts Key-Seats AUTOMATICALLY for the WOODRUFF PATENT SYSTEM OF KEYING. Thousands of milling operations are being made on expensive machines which could be done in less than one-half the time on this Miller costing less than one-half the money.

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The universal favor in which your excellent Woodruff System of Keying is held leaves nothing for us to say, further than that we fool indorse it

Your Milling Machine is one of the most indispensable tools in our Milling Department, on account of its adaptability to many special uses.

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JONES & LAMSON MACHINE CO.

The Whitney Mfg. Co.

Hartford, Conn., U. S. A.

FOREIGN AGENTS: Messrs. C. W. Burton, Griffiths & Co., London; Messrs. Fenwick Freres & Co., Paris, France; Messrs. Schuchardt & Schutte, Berlin.

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Providence, R. I. :: U. S. A.

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ANGULAR CUTTERS
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Special Cutters are given careful attention.

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Meadville Vise Co., Meadville, Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pawling & Harnischfeger, Milwaukee, Wis.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Turning Mills
American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Betts Mach. Co., Wilmington, Del.
Bickford & Co., H., Lakeport, N. H.
Bullard Mach. Tool Co., Bridgeport, Conn.
Colburn Mch. Tool Co., Franklin, Pa.
Gisholt Mach. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
King Mach. Tool Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Poole Co., J. Morton, Wilmington, Del.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Brazing
Standard Brazing Co., Boston, Mass.

Bulldozers
Ajax Mfg. Co., Cleveland, O.

Cabinets, Oil
Bowser Co., S. F., Fort Wayne, Ind.

Carbon Paper
Hano & Co., Philip, New York.

Carborundum
See Grinding Wheels.

Case-Hardening
Rogers & Hubbard Co., Middletown, Conn.

Castings, Brass and Bronze
Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Taunton Loco. Mfg. Co., Taunton, Mass.

Castings, Motor
Harrison, H. K., St. Paul, Minn.
Steffey Mfg. Co., Phila., Pa.

Castings, Steel
Cooper-Wigand-Cooke Co., New York.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
West End Mfg. Co., New York.

Centering Machines
Kempsmith Mfg. Co., Milwaukee, Wis.
Phoenix Mfg. Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.
Whiton Machine Co., D. E., New London, Conn.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Chains, Driving
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Federal Mfg. Co., Cleveland, O.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Morse Chain Co., Trumansburg, N. Y.
Oneida Community, Kenwood, N. Y.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Cushman Chuck Co., Hartford, Ct.
Detroit Twist Drill Co., Detroit, Mich.
Goodell-Pratt Co., Greenfield, Mass.
Horton & Son Co., The E., Windsor Locks, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Niles-Bement-Pond Co., New York.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., The E., Windsor Locks, Conn.
Niles-Bement-Pond Co., New York.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Magnetic
Walker & Co., O. S., Worcester, Mass.

Chucks, Planer
Niles-Bement-Pond Co., New York.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.
Hardinge Bros., Chicago, Ill.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Carlyle Johnson Mach. Co., Hartford, Conn.
Cresson Co., Geo. V., Phila., Pa.
Faneuil Watch Tool Co., Boston, Mass.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Smith, F. L., Franklin Falls, N. H.

Clutches, Magnetic and Electrical
Electric Controller & Supply Co., Cleveland, O.

Compound, Boiler
Harris Oil Co., A. W., Provi., R. I.

Compound, Pipe Joint
Dixon Crucible Co., Jos. Jersey City, N. J.

Compressors, Air
Blaisdell Machinery Co., Bradford, Pa.
Blanchard Mach. Co., Boston, Mass.
Christensen, N. A., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Connecting Rods and Straps
Hussey Drop Forge & Mfg. Co., Cleveland, O.
Standard Connecting Rod Co., Beaver Falls, Pa.

Contract Work
Pope Mfg. Co., New York.
Taunton Loco. Mfg. Co., Taunton, Mass.

Controllers and Starters, Electric Motor
Electric Controller & Supply Co., Cleveland, O.
General Electric Co., New York.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

Correspondence Schools
See Schools, Correspondence.

Counterbores
Slocomb Co., J. T., Provi., R. I.

Countershafts
Builders' Iron Fdry., Provi., R. I.
National Machine Tool Co., Cincinnati, O.
Power & Speed Controller Co., Boston, Mass.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.

Couplings, Shaft
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.
Vandegrift Coupling Co., Evansville, Ind.

Cranes
Brown Hoisting Mach. Co., New York.
Case Mfg. Co., Columbus, O.
Chambersburg Engineering Co., Chambersburg, Pa.

Cranes—*Continued*
Cleveland Crane & Car Co., Wickliffe, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Lane Mfg. Co., Montpelier, Vt.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.

Crank Pin Turning Machine
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

Crank Shafts
Hussey Drop Forge & Mfg. Co., Cleveland, O.
Standard Connecting Rod Co., Beaver Falls, Pa.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Cupolas and Ladles, Foundry
Byram & Co., Inc., Detroit, Mich.
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Philadel., Pa.
Stevens, F. B., Detroit, Mich.

Cut Meters
Warner Instrument Co., Beloit, Wis.

Cutters, Milling
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Gay & Ward, Inc., Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Whitney Mfg. Co., Hartford, Ct.

Cutting-off Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Mach. Co., W. P., Rochester, N. Y.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.

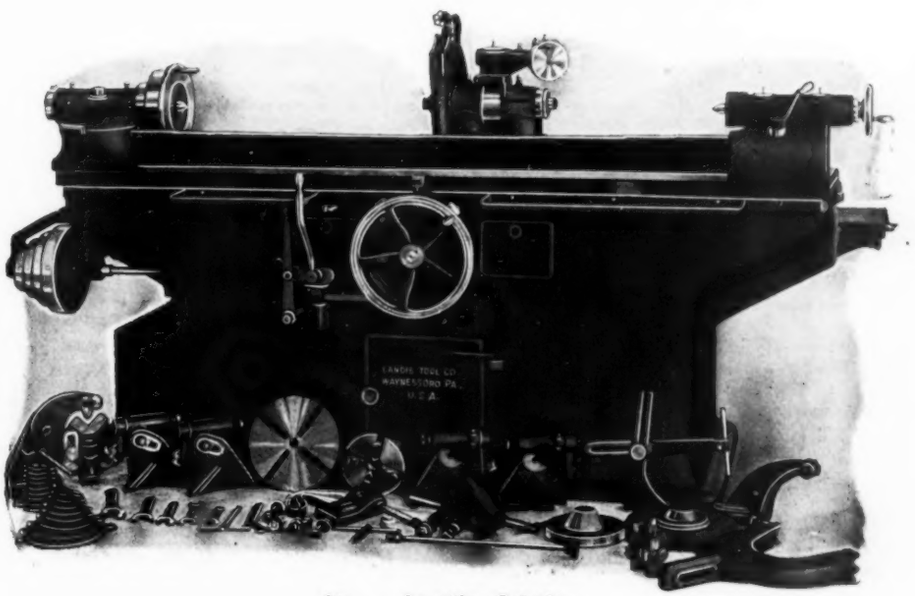
Cutting-off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Fairbanks Machine Tool Co., Springfield, O.
Goodell Mfg. Co., Greenfield, Mass.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.
Western Tool & Mfg. Co., Springfield, O.

Diamond Tools
Dickinson, Thos. L., New York.
Steel Set Diamond Co., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press & Tool Co., Chicago, Ill.
Crucible Steel Forge Co., Cleveland, O.
Delivouk & George, Chicago, Ill.
Gem Mfg. Co., Pittsburg, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Hay-Budden Mfg. Co., Brooklyn, N. Y.
Perkins Mach. Co., So. Boston, Mass.

The Modern Business Combination Is:

High Speed Steel for Roughing, Landis Grinders for Finishing.



No. 4 Landis Grinder.

By adopting this method you get your machine work done with the utmost rapidity, the highest possible degree of accuracy, and the greatest economy known.

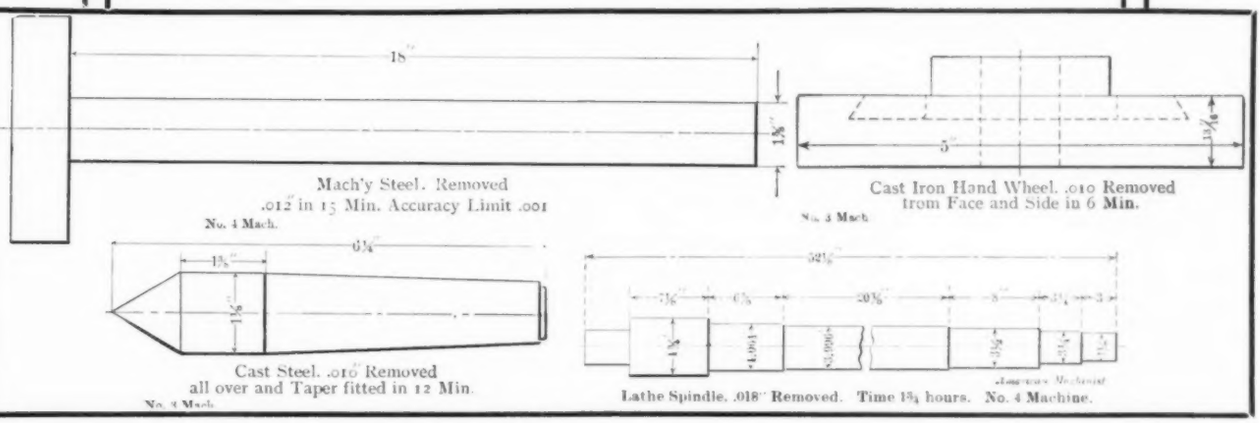
Landis Grinders are built in various sizes to suit all requirements. The bearings are of an improved design which will positively not let any grit or water in. The slides and working parts are thoroughly protected from injury by water, emery dust, or the accidental dropping of wrenches, etc.

With Landis Grinders a workman can grind to within the .00001 part of one inch if necessary, and he does not have to have a special training to do it either.

Send us your address and we will tell you all about the various Landis Grinders and their attachments, also give you some valuable cost-reducing suggestions.

Landis Tool Co., Waynesboro, Pa., U.S.A.

AGENTS:—Walter H. Foster Co., New York, Boston, Cleveland and Pittsburg. C. W. Burton, Griffiths & Co., London. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg, Liege, Milano, Paris and Bilbao. A. R. Williams Machinery Co., Toronto. Williams & Wilson, Montreal, Can.


18"
1⅜"
5"
Mach'y Steel. Removed .012" in 15 Min. Accuracy Limit .001
No. 4 Mach.
Cast Iron Hand Wheel. .010 Removed from Face and Side in 6 Min.
No. 3 Mach.
6¼"
1⅜"
1⅛"
Cast Steel. .010" Removed all over and Taper fitted in 12 Min.
No. 3 Mach.
32½"
Lathe Spindle. .018" Removed. Time 13¾ hours. No. 4 Machine.

Dies, Threading, Opening
Errington, F. A., New York.
Geometric Drill Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Dowel Pins
Beskin Mfg. Co., Canton, O.
Obermayer Co., S., Cincinnati, O.
Winkley Co., Hartford, Conn.

Drafting Machines
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards and Tables
Fritz & Goedel Mfg. Co., Grand Rapids, Mich.
Keuffel & Esser Co., New York.
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Alteneder & Sons, Theo., Philadelphia, Pa.
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

Drilling Machines, Boiler
American Tool Wks. Co., Cin., O.
Bickford Drill & Tool Co., Cincinnati, O.
Boynton & Plummer, Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dallett Co., Thos. H., Phila., Pa.
Fenn-Sadler Machine Co., Hartford, Conn.
Flather Planer Co., Mark, Nashua, N. H.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
National Auto. Tool Co., Dayton, Ohio.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.

Drilling Machines, Pneumatic
Cleveland Pneu. Tool Co., Cleveland, O.
Ingersoll-Sergeant Drill Co., New York.
Niles-Bement-Pond Co., New York.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

Drilling Machines, Portable
Coates Clipper Mfg. Co., Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mch. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mueller Mach. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Vandyck Co., J. R., New York.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Boynton & Plummer, Worcester, Mass.
Burke Machinery Co., Cleveland, Ohio.
Cincinnati Mach. Tool Co., Cin., O.
Dallett Co., Thos. H., Phila., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Knecht Bros. Co., Cincinnati, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mechanics Machine Co., Rockford, Ill.
Moline Tool Co., Moline, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Prentiss Tool & Supply Co., New York.
Sibley & Ware, South Bend, Ind.
Sloan & Chace Mfg. Co., Newark, N. J.
Vandyck Co., J. R., New York.
Washburn Shops, Worcester, Mass.
Whitney Mfg. Co., Hartford, Conn.

Drilling Machines, Turret
Niles-Bement-Pond Co., New York.
Quint, A. D., Hartford, Conn.
Vanderbeek Tool Works, Hartford, Conn.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.

Drills, Hand
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

Drills, Rail
Niles-Bement-Pond Co., New York.

Drills, Ratchet
Greene, Tweed & Co., New York.
Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
General Electric Co., New York.
Holtzer-Cabot Elec. Co., Brookline, Mass.
Jantz & Leist Elec. Co., Cin., O.
Keystone Electric Co., Erie, Pa.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co, Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrical Supplies
Commercial Electric Co., Indianapolis, Ind.
Emerson Electric Mfg. Co., St. Louis, Mo.
General Elec. Co., New York.
Keystone Electric Co., Erie, Pa.
Roth Bros. & Co., Chicago, Ill.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrically Driven Tools
Hisey-Wolf Mach. Co., Cincin., O.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheel Dresser
Desmond-Stephan Mfg. Co., Urbana, O.
Standard Tool Co., Cleveland, O.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engineer, Consulting and Mechanical
Hollingsworth, Samuel, Plainfield, N. J.
McGeorge & Sons, Cleveland, O.

Engines, Automobile
Olds Gasoline Engine Works, Lansing, Mich.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Foos Gas Eng. Co., Springfield, O.
Jacobson Mach. & Mfg. Co., Warren, Pa.
Mietz, August, New York.
New Era Gas Engine Co., Dayton, Ohio.
Olds Gasoline Engine Wks., Lansing, Mich.
Regal Gasoline Engine Co., Coldwater, Mich.
Struthers-Wells Co., Warren, Pa.
Woolley Fdry. & Mach. Co., Anderson, Ind.

Engines, Oil
Mietz, August, New York.

Engines, Steam
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Boston, Mass.

Engraving Machinery
Gorton Mach. Co., Geo., Racine, Wis.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Exhibition, Machinery
Philadelphia Bourse, Phila., Pa.

Fans, Electric
Emerson Electric Mfg. Co., St. Louis, Mo.
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Fans, Exhaust
American Blower Co., Detroit, Mich.
Sturtevant Co., B. F., Boston, Mass.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

Filing Machines
Cochrane-Bly Mach. Works, Rochester, N. Y.
Kinsey-Burt Co., New York.

Filler, Iron
Felton, Sibley & Co., Phila., Pa.
Smith Foundry Supply Co., J. D., Cleveland, O.

Fillers, Oil Can
Winkley Co., The, Hartford, Conn.

Fillets, Leather and Wood
Beskin Mfg. Co., Canton, O.
Canton Fillet Co., Canton, O.

Filters, Oil
Burt Mfg. Co., Akron, O.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.
Stow Mfg. Co., Binghamton, N. Y.

Forges
Boynton & Plummer, Worcester, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Ingersoll-Sergeant Drill Co., New York.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Boston, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Clapp Mfg. Co., E. D., Auburn, N. Y.
Hussey Drop Forge & Mfg. Co., Cleveland, O.
Lang Co., G. R., Cincinnati, O.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Crucible Steel Forge Co., Cleveland, O.
Hay-Budden Mfg. Co., Brooklyn, N. Y.
Heppenstall Forge & Knife Co., Pittsburg, Pa.
Lang Co., G. R., Cincinnati, O.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Byram & Co., Inc., Detroit, Mich.
Gem Mfg. Co., Pittsburg, Pa.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Philadel., Pa.
Smith Foundry Supply Co., J. D., Cleveland, O.
Stevens, F. B., Detroit, Mich.

Furnaces, Coal and Oil
Obermayer Co., S., Cincinnati, O.
Rockwell Engineering Co., Jersey City, N. J.

Furnaces, Gas
Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Rockwell Engineering Co., Jersey City, N. J.
Westmacott Co., J. M., Providence, R. I.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Galvanizing Machinery
Erie Foundry Co., Erie, Pa.

Gear Cutting Machinery
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bultman & Co., F. H., Cleveland, Ohio.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Whiton Machine Co., D. E., New London, Conn.

The Obscure Cause of Failure of a Corliss Engine Governor to Regulate.

BY YESTRIC LAND.

It is now a good many years ago—I feel impelled to furnish this assurance promptly, so that whatever evidence of inexpertness with which I may in the following implicate myself shall now be counted for naught; for it is likely that inexperience is not always such a constant factor that time and exposure to mechanical processes do not tend to vary it. However, I found myself one night on board a C. & Q. sleeper, turning over in my imagination a Corliss valve gear reported to allow the engine, which it was supposed to regulate, to run wild; and while the car wheels measured the miles on the rail joints, I imagined myself listening to a distressing knock, whose origin and cause I had been sent out to find and remedy. By considering carefully the workings of every law of nature which I at the time could recall to mind, I tried to discover why this particular engine behaved as it had been reported. In imagination I took the governor apart and tested every joint and journal, in hopes of finding some stiff knuckle that would carry with it an explanation, but I could settle upon none as a probable cause of the trouble. Even the consistency of the oil that might have been used in connection with the governor, and have any influence on the regulation, was subjected to a series of minute considerations. It may be unnecessary to say that I had not, at that time, yet grown used to the road, and that therefore any very profound sleep for the occasion was dispensed with.

The next morning I was up against the real thing. It was a 24x42x48-inch, cross-compound affair, which looked to me, in the light of the early morning, about twice as big as an ordinary engine of these dimensions generally does. The circumstances were all explained to me thoroughly, and I found, to my regret I might say, that nearly all the precautions and examinations which I had been making the subject of my nocturnal contemplations, had been taken and made, and I was assured that no particular part which I could suggest was at fault.

I saw at once that I could not pick things to pieces as easily as I had been doing in my imagination, particularly as the engine could not be stopped except at certain short intervals during the day. Confining myself, therefore, to some simple expedients, I took off the heavy governor balls, and, by using a good part of my capacity for generating muscular energy in an awkward position, I was able to move the complete governing gear which, considering the whole system of levers and connections to which it was attached, did not seem to move as if held by undue friction. Two connections that were easily disconnected were also removed, and the governor gear was thus tried in sections. This resulted in convincing me, fairly well, that the cause of the trouble was not concealed in any undue tightness of anything belonging to the regulation gear. As, however, something had to be done without much delay, a new governor pulley of smaller diameter was ordered from a nearby shop, together with a weight and weight-arm for counterweighing the balls, so as to keep the speed of the engine unchanged, although the governor was speeded up some. The engine speed, however, was everything except a constant quantity, ranging, I believe, from 60 to 120 turns per minute, just as the fancy of the governor seemed to want it. The change to the new pulley was made the following night with a result of no appreciable improvement.

My attention was next drawn to the pins on the high-pressure release levers, which protruded more than commonly. These must be shortened at any cost, because that the extra twisting pull on account of the offset of these pins was the cause of all difficulty, there seemed then no doubt. To make this change took quite a little time, as a good many wrinkles had to be overcome in order to get a straight lead from the governor lever to the new location of the release arm pins. The night following the completion of all the multiplex parts required for this change they were put in place, but the only noticeable effect was in overawing any casual observer by the very ingenious complication.

The next night was devoted to taking down the governor shaft, which extended between the engines, and boring out the ends of the brackets in which it was journaled, so as to make sure that the shaft had no opportunity to bind on account of the slight inevitable sag which it took when in position. A couple of springs were also made and put on the governor. Of these, the first one was too weak to have any effect at all, but the second, which was quite heavy, improved things somewhat. Still the governor was reprehensively unstable. Fred, the handy-man, said it acted just like a certain governor in North Carolina, which he knew about,

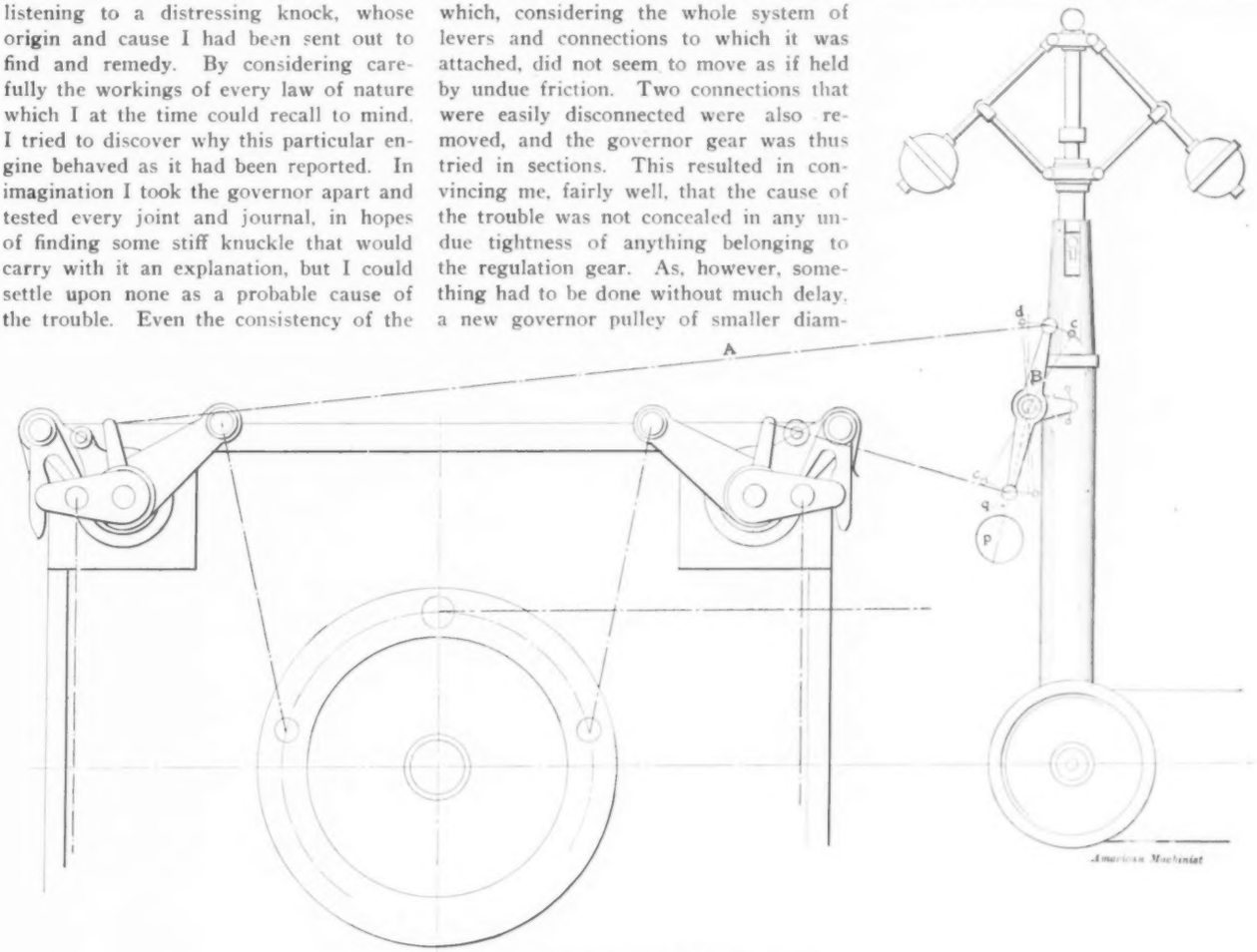


FIG. 1. THE TROUBLESOME GOVERNOR GEAR.

and the only way to fix him, he added, was to give him more spring. This suggestion I did not act upon, as the spring already provided seemed to be even more than good looks would warrant.

In the meantime the complained of knock in the engine had been examined and found to occur only occasionally in the low-pressure crank box and in the main journal of the same side. As it occurred only at times of extra high speed, it was thought that it would be cured by getting the governor in shape so as to promptly take care of any incipient spurt of effort on the part of the engine. However, finding it necessary to try to sooth in some way the, at this time, rather unstrung nerves of the engineer in charge, after a liberal use of antifriction cigars had proven themselves the wrong medicine, measures were taken to alleviate the distressing knocks by giving the engine all the compression that could be had. This proving ineffective, it was decided that the journal boxes were too loose, and they were accordingly set up, with the result that one pair of crank boxes and one main journal had to be rescraped the following night.

After things were put in running order again, I concluded that, as experimenting had not proved successful, it was time to see if the application of a little theory would not help out of a distressing situation. Counting, therefore, the number of turns the engine made when racing, and finding it to be about 120, I calculated the corresponding maximum velocity of the crank pin, estimated the weight of the reciprocating parts and found the pressure required to give them their acceleration at the beginning of the stroke to be about 31 pounds per square inch of piston. As the effective pressure on the piston did not amount to more than 22 pounds per square inch, the flywheel was therefore called upon to furnish, for a short period of time at the beginning of each stroke, the difference of 9 pounds per square inch on a total of about 12,500 pounds. In doing this the backlash of the crank boxes, after having just passed the center, must cause a knock, when the journal boxes, as had been found, would not stand tightening.

It was now plain that any compression in the cylinder would not help matters, and that the only way to get rid of the knock was to prevent the engine from racing, or to increase the receiver pressure so as to get about 31 pounds initial effective pressure behind the low-pressure piston. On the other hand, supposing the engine to run at its normal speed of 90 turns per minute, then the initial acceleration pressure would be 18 pounds per square inch of piston, which was within the existing initial effective pressure.

Further reflection, with the aid of a sketch, Fig. 1, which shows the governor and connections to the low-pressure side, soon made it clear wherein lay the real trouble with the regulation. The connection *A* to the rear release arm was a very long and heavy affair, one end of which rested on the arm *B*, about 10 inches long. With the governor revolving in its lowest position, the governor arm was at *c c;* but, as the governor responded to a change of load or boiler pressure by rising, the leverage *c d*, on which the weight of the rod acted, decreased; thereby making it more and more easy for the governor balls to rise the higher they went. This was, in effect, the same as an increase of the sensitiveness of the governor.

Consider, now, that the sensitiveness is decided upon when designing a governor which is, as a rule, made as sensitive as is practicable, and it is plain that it will not generally lead to good results if an unbalanced weight is installed anywhere in connection with the regulating system in such a manner as to increase the sensitiveness of the governor, because the regulation then becomes oversensitive, a condition which shows itself by the disinclination of the governor balls to assume any position excepting a top or bottom one.

The trouble, when found, was very easily remedied in a temporary way by simply applying a counterweight *p*, on an arm *q*, which counteracted the effect of the weight of rod *A* acting on the arm *B*. As this temporary expedient was not, however, very attractive in appearance, a permanent change was made as shown in Fig. 2, which removed all difficulties in regard to the engine.

It may be profitably remembered by all who have anything to do with the erecting or starting of Corliss engines that the feature of the regulating mechanism of this engine which created so much all around trouble before it was discovered, is one that attaches to nearly all Corliss engines. In many cases it has no particular influence on the operation of the engine, but, next to a sticky regulation, it is the most common cause of failure of the regulation of large Corliss engines.

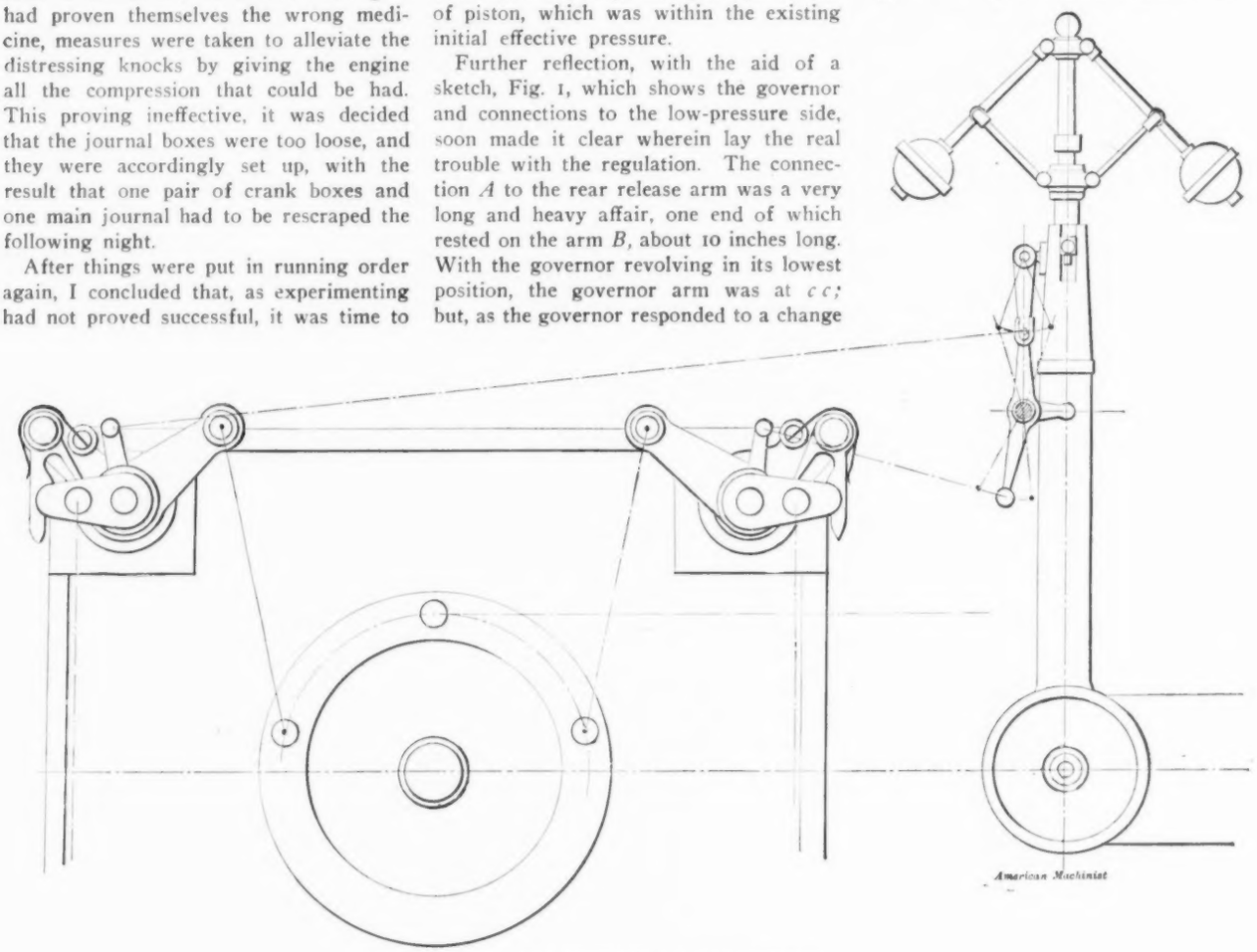


FIG. 2. THE GOVERNOR GEAR AS MODIFIED.

In the Bank of England electric motors are to be used for driving the printing presses and other machinery, but they don't use the telephone there.

The Nordberg Reversing Gear.

BY R. A. WRIGHT.

At pages 833 and 881, Vol. 22, the AMERICAN MACHINIST published an account of the large Nordberg hoisting plant at the Tamarack Mine, in Northern Michigan, in which mention was made of a special type of reversing gear using ordinary spur gears. Having had occasion recently to work up and detail a reverse gear of this type, it has occurred to me that a further description of this mechanism might be of interest.

The sketch, Fig. 1, shows a diagram explaining the action of the device. To begin at the beginning, of course the requisite for reversing an engine is to be able to shift the eccentric through twice the angle between it and the crank, or, in Fig. 2, from E to E', the position of the crank being at C. This is accomplished, in the various link motions, not by shifting the eccentric but by having two eccentrics, set as at E and E', and changing the connection between them and the valves, so that only one of them drives and the other is idle.

The Nordberg reversing gear consists of four gears, of which the upper pair X and X', Fig. 1, are in mesh with each other, and each is in mesh with the one below it, Y and Y' respectively, but the lower pair are enough smaller to clear each other. Of course all four gears are held to the same relative center distances, but the upper pair may move by rolling on the lower pair, as indicated in dotted lines. Let us assume that the gear Y' is prevented from turning and the upper pair are shifted to the dotted position, the angle through which their centers are moved being α. Then, since the arc C, from Z' to W'' must be equal in both X' and Y', we have

$$C = \frac{2\pi r \alpha}{360} = \frac{2\pi R \phi}{360}$$

whence

$$\phi = \frac{2\pi r \alpha}{2\pi R} = \alpha \frac{r}{R}$$

The point of contact T has moved to the new positions T' and T'', and since T is 90 degrees from Z', the angle

$$\psi = \psi' = \phi + \alpha = \alpha\left(1 + \frac{r}{R}\right)$$

The point of contact Z, which was 90 degrees from T, is now 90 degrees from T'' at Z''. If C' is the arc between Z'' and the new contact point W and the corresponding angle,

$$\theta = \psi + \alpha = \alpha\left(2 + \frac{r}{R}\right) \qquad (1)$$

Taking this same length of arc C' on the circle Y, we find the point S, which is the new position of the former contact point Z, and this gear has moved through the angle Ω. Then

$$\Omega = \alpha + \frac{360}{2\pi r} \times C'.$$

From the upper circle X,

$$C' = \frac{2\pi R}{360} \times \theta.$$

Hence

$$\Omega = \alpha + \frac{R\theta}{r}$$

and from (1)

$$= \alpha\left\{1 + \left(2 + \frac{r}{R}\right) \times \frac{R}{r}\right\}$$

$$= 2\alpha\left(1 + \frac{R}{r}\right)$$

This gives us a definite formula for the relation between the movement of the reversing gears and the angle through which the eccentric is shifted. This latter angle may be either twice the angular advance or its supplement. The latter case would give the least movement of the reversing mechanism, since the eccentrics are set more than 90 degrees ahead of the crank. On the other hand, when the larger angle is used the direction of tooth pressure when the engine is running tends to keep the reversing gears at their extreme position instead of having a tendency to reverse, as is the case when the smaller angle is used.

The gear Y' is either directly on the engine shaft or driven from it by means of gears or eccentrics, and Y is on a lay shaft which carries the eccentric, or eccentrics in case of a pair of engines, for driving the valve gear. A modification of this gear consists in using a bevel pinion working between a pair of bevel wheels and capable of swinging about the common axis of the wheels. In this case the relative angular movement of the bevel wheels is double the angle through which the pinion is swung, and is entirely independent of the proportions of the gears. Another method of accomplishing this result is by means of a sliding nut having right and left thread of very steep pitch. Both of these latter methods are inferior to the spur-gear type in point of efficiency as well as economy of construction.

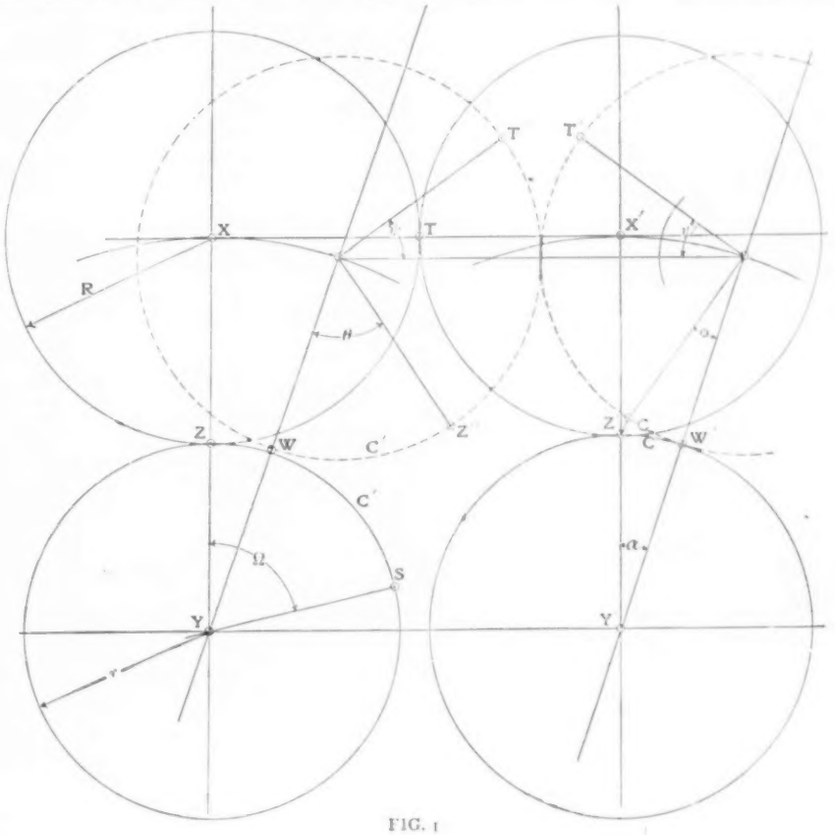


FIG. 1

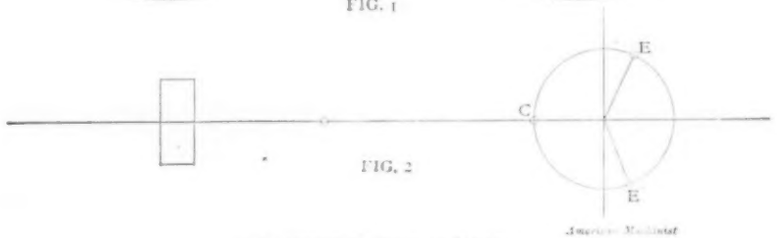


FIG. 2

THE NORDBERG REVERSE GEAR.

There is a steadily growing demand for the steel wire barrel hoop in place of the regular hoop of elm, on account of the increasing scarcity of the latter material. The wire used is of No. 9, 10, 11 or 12 gage, with the ends twisted together. These hoops cost no more than those of wood and are used for flour, sugar, apples and other purposes. They are a nuisance when the barrels have been used for bonfires.

English Results With High-Speed Steel—I.

It is well known that English steel makers have shown great activity in developing the manufacture and use of high-speed steels and our readers will find much of interest in the following extracts from a paper on this subject which was read at a recent meeting of the Coventry Engineering Society by J. M. Gledhill, of Sir W. G. Armstrong, Whitworth & Co.

Following is a list of some of the metals used as components of high-speed steel with their present values:

	Value	
	Per pound	Per long ton
Vandium.....	$9.73	$21,800
Molybdenum	1.46	3,270
Tungsten.....	.61	1,362
Nickel.....	.36	817

In forging tools made from "A. W." steel it is necessary to cut off the required lengths at a forging heat. The lengths must not be broken off cold, as this tends to cause cracks in the bars. For forging, the steel should be placed in the fire, and slowly but thoroughly heated, taking care that the heating has penetrated to the center of the bar, and then forged at a bright red heat. While forging, the bar should not be allowed to get lower than a good red. After the tool is forged it should be laid down in a dry place and allowed to cool slowly. To harden the tool the nose only should be gradually, but fairly rapidly, raised to a white melting heat, and then cooled with an air blast. If during this heating the point of the nose becomes fused or melted, no harm whatever has been done.

After grinding, which should be done on a wet stone, the tool is ready for use.

To obtain the maximum efficiency from the "A. W." steel it is essential that the nose of the tool shall be raised to a white melting heat as described.

Another method which may be described of preparing the tools is as follows:

Forge the tool as before, and when cold roughly grind to shape on a dry stone or dry emery wheel. It then requires heating to a white heat, just short of melting, and cooling in the air blast. This method also lends itself for cooling the tools in oil; before which the temperature has to be lowered from the white heat to a good red heat (about 1,600 degrees Fahr.) either by the air blast or in the open, and then quenched out in oil. Tools hardened by the latter method are specially good, where the retention of a sharp edge is a desideratum, as in finishing tools, capstan and automatic lathe tools, brass workers' tools, etc.

Referring to the question of grinding the tools, nothing has yet been found to be so good for air hardening steels as the wet sandstone, and the tools ground by hand thereon, but where it is desired to use emery wheels we recommend users to adopt the system where the tools are roughly ground to shape on a dry emery wheel or stone before hardening. By this means the tool requires but lightly grinding after hardening, which should be done by hand. When the tools are ground on a wet emery wheel and undue pressure is applied, the heat generated by the great friction between the tool and the emery wheel causes the steel to become very hot, and water playing on air hardening steel while in this heated condition tends to produce cracking.

It is now possible with our "A. W." high-speed steel to turn and machine steel at a rate up to 400 feet per minute, and also to drill cast iron at 25 inches per minute. These are indeed remarkable speeds when it is remembered that only a comparatively short time back with the ordinary crucible steels a cutting speed of 30 to 50 feet per minute was more like the limit.

The above figures can only appeal to all as profoundly remarkable. Could our engineering forefathers but return, and be told that such speeds were being attained in our workshops, they would doubtless say, "Politeness forbids a true expression as to what I think of your statement."

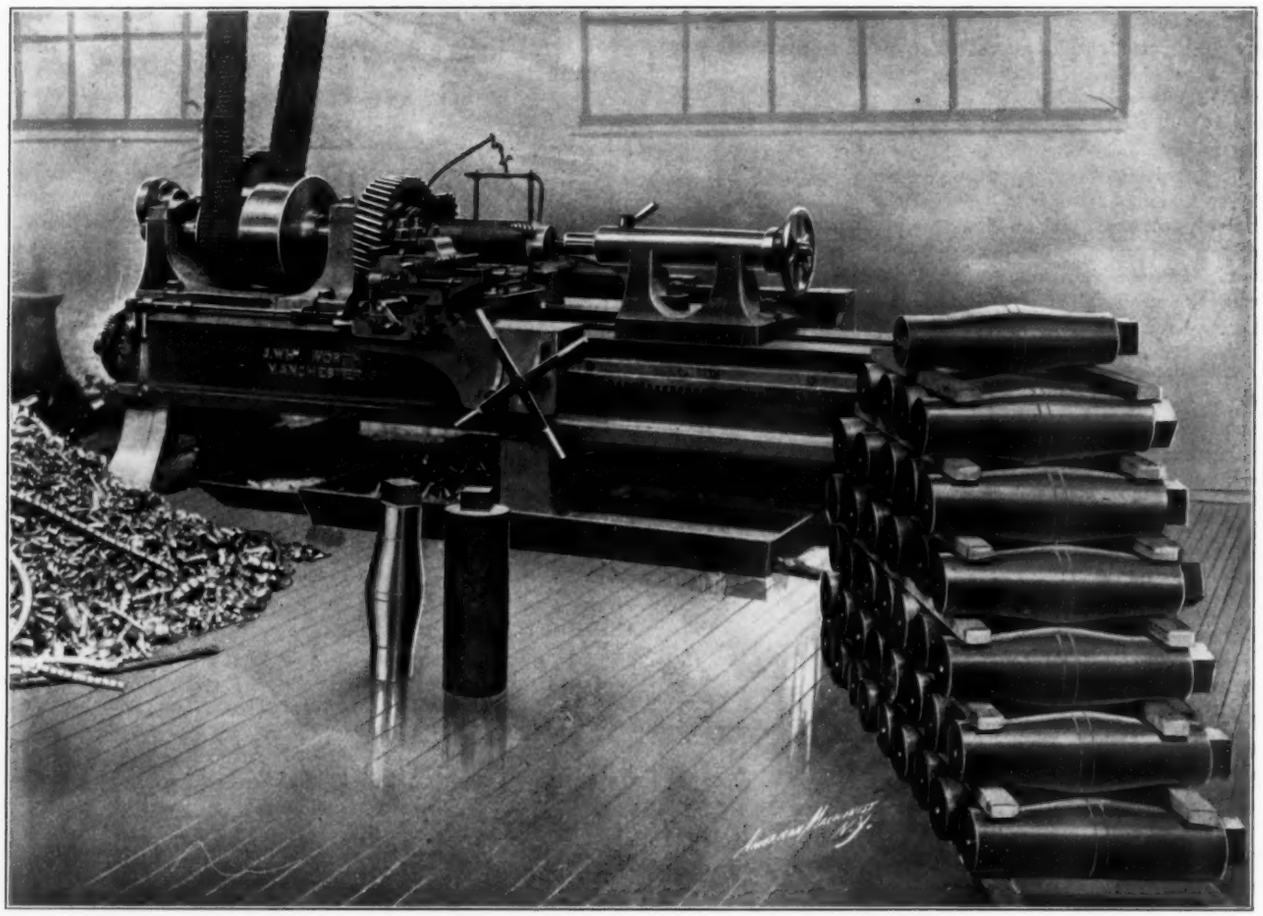


FIG. 1. SPECIAL LATHE FOR ARMOR PLATE BOLTS WITH DAILY OUTPUT.

Nevertheless, facts are stubborn things, as regards these speeds.

It is to Messrs. Taylor & White, of America, that the credit of initiating high-speed cutting is due, and who, some few years back, showed what was then considered to be some remarkable cutting speeds. It will, however, not be denied that the improvement and development beyond their process that has taken place during the past few years is due to our own country, for whereas in the Taylor-White process their steel could not be sent out in bars, but only in the form of finished tools specially treated on the nose only,* now high-speed steel, manufactured in this country, is delivered to users in the ordinary way, and further, its forging and treatment is absolutely simple—in fact, simpler, and is accompanied by less risk, than in the case of ordinary tool steel.

It will therefore be seen that the very exceptional treatment required in preparing these tools precluded their adoption and use commercially, and it is a remarkable fact that the English manufacturer is now exporting high-speed steel on a large scale to America.

In forging, annealing and hardening crucible steels it is essential that the most suitable temperatures should be found for all of these processes, and then accurate means be taken to ensure such temperatures being actually obtained as near as practically possible. This can only be effected by the skillful use of pyrometers or other scientific heat-recorders, for to work on the old-fashioned lines of judging by the eye is no criterion of actual temperature, and is no longer advisable. It is now known that every composition of steel has its own definite temperature that is best suited for obtaining from it the most satisfactory results, and the nearer this can be worked to the better, and any deviation from the correct temperature, up or down, involves a corresponding difference in the efficiency of the steel.

It will therefore be seen how important it is that in heating steel all respect should be paid to temperature, in order to get out of it all the best inherent qualities. One can imagine a bar of steel saying to those about to treat it, "Heat me properly, and I will serve you well; but heat me badly, and I will abandon you."

Of course, it cannot now be denied that machine tools which were fully equal to the cutting power of the old kinds of tool steels are now quite unequal to the capabilities of the high-speed steel—not in driving power alone, but in the absence of rigidity and general strength of working parts for obtaining the utmost work that the high-speed steel is capable of performing. Purchasers of machine tools will doubtless, in obtaining new designs, note this, so that machines and tool steels which are going to be used in them should be, so to speak, approximately equated. Want of power and strength is undoubtedly being realized, and rapid strides are being made by the leading toolmakers to bring their designs into line with the steel.

A proof of this might here be given: We had at our works an ordinary 12-inch [24-inch by American measurement] lathe, turning armor plate bolts of from 4 to 5 inches diameter, and we thought we did wonderfully well in turning them at a cutting speed of 80 feet per minute. We found the tool at the end of the day's work to be practically as good as at the commencement, and this caused an increase of speed to be suggested.

It was found, however, that the lathe had not sufficient power to admit of any increase of speed, and yet it was felt beyond doubt that if we could only get the required power we could run at double the cutting speed.

We therefore designed a special lathe, shown in Fig. 1, with an increased width of belt from 4 to 7½ inches width and an increase of the belt velocity of 400 feet per minute. The lathe was duly put to work, and we immediately began to cut at a speed of 152 feet per minute, the same depth of cut and feed being maintained as

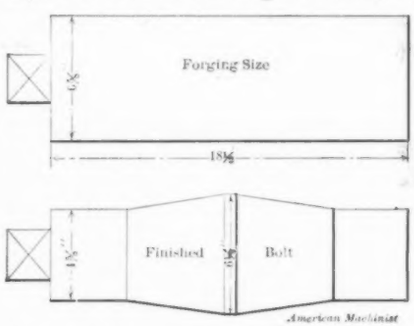


FIG. 2. DIMENSIONS OF ARMOR PLATE BOLTS TURNED IN THE LATHE SHOWN IN FIG. 1.

when we were cutting at 80 feet per minute, while the tool, which is 1¼ inches square in section, lasts from seven to eight hours without requiring to be reground. One day's work is shown by the side of the lathe. It will be seen that the plain rolled bar is shown alongside a finished piece.

The bolts machined in this time, the dimensions of which, both rough and finished, are given in Fig. 2, are forty in number, as against a production of only eight when using ordinary self-hardening steel. The following are the actual cutting speeds and feeds on these bolts: Cutting speed, 152 feet per minute; depth of cut, ¾ inch; feed, thirty-two cuts per minute; actual metal removed, 62 pounds per bolt, or 2,480 pounds in the day of ten hours.

Another excellent example of high-speed cutting by "A. W." steel may be cited: Turning oil-hardened gun-metal having a tensile strength of 40 to 45 tons per square inch, the cutting speed was 50 feet per minute, eleven cuts per inch, while the depth of cuts varied from 3-16 to 11-16, the tool cutting nine hours without interruption.

There is another point raised by some users of high-speed steel, and that is as to its having been found brittle. This, however, is not the case if the steel is properly hardened, the hardening confined to the cutting area, and proper support given to the tools when fixed in the machine.

Many other examples might be given of our own practise and that of the great Elswick Works, which are using "A. W." high-speed on a very extensive scale, but it will suffice to annex one or two standard examples: Turning a gray-iron flywheel, 12 feet diameter, 12-inch face; cutting speed, 35 feet; depth of cut, ¾ inch; feeds four cuts per inch. (This wheel had barring holes in the center about 8 inches pitch.)

Ordinary self-hardening steel refused to start on this job at the speed, after which an "A. W." tool was applied and finished the wheel. In addition to using high-speed steel for turning, planing, slotting and boring tools, it can also be most advantageously used for milling cutters, twist drills, taps and screwing dies, reamers, wire drawing, tube expanding, etc. Correspondingly increased speeds can also be obtained with high-speed steel when turning hard materials like Chrome steel for projectiles, old railway wheel tires, hard gray iron, etc.

A subject that must be of the greatest importance to all engineers is that of milling, as by the use of this method of working a much greater output of production can often be obtained. By the use of cutters made of high-speed steel, still greater economies are effected, for not only can higher cutting speeds be used than when using ordinary carbon steel cutters, but the cutters made from the former can be run for much longer periods without being ground, and as the grinding of milling and similar cutters is a comparatively costly operation, a further economy is thus effected.

In support of these statements, a few results may be submitted taken from the daily practise at our works. A pair of straddle mills, 7 inches diameter and 1½ inches wide, made of "A. W." steel, were used to cut an inverted T-section from bars of forged steel, 7 feet 3 inches in length, each cutter taking a cut 1½ inches deep and 9-16 inch wide at a feed of 1⅛ inches per minute, the cutting feed being 75.5 feet per minute. After milling eighteen of these bars—a total length of 130.5 lineal feet—and cutting continuously for twenty-three hours and removing 380 pounds each, the cutters were quite uninjured.

Another record, but of a rather different character, may also be mentioned. The cutters in question were 4 inches diameter and 2 inches wide, and were employed on surfacing work in crucible cast steel, taking a cut 1-32 inch deep at a feed of 1½

* We think this is an error.—ED.

inches per minute, the cutting speed being 90 feet per minute. These cutters have cut continuously for sixty hours without being reground, whereas when using cutters made of ordinary crucible steel at a slower speed, it was necessary to grind them every six hours.

To give an idea of what marvelous results can be obtained from these cutters I will mention a trial that took place at our works some time ago. An "A. W." cutter 5⅛ inches diameter and 1⅛ inches wide cut several lengths of a cast-iron block 12 inches long, the cutting speed being 174.5 feet per minute, cut ⅛ inch deep with a feed of 16 inches per minute, while the same cutter, without being reground, took a finishing cut at 357 feet per minute, and feeding 30 inches per minute.

It will no doubt be interesting at this stage to give the most suitable process for the heating, hardening and tempering of these cutters. It is advisable to first fill up the hole and machined parts which it is required to keep to size for fitting on the arbor and keys, with common fireclay. Then place the cutters into a cold muffle furnace. Heat up gradually to a red heat. Then transfer the cutters to another furnace ready heated to a very bright yellow, about 2,200 degrees Fahr., and allow the cutter to remain in until the teeth or cutting edges are heated to the same temperature as the furnace. Place the cutters under the air blast until the temperature is lowered just below visible red—that is, 1,000 Fahr. Remove away from the blast and place in a pan containing tallow, and then heat up the pan to a temperature ranging from 500 to 600 degrees Fahr. Take out and allow to cool gradually, keeping away from cold drafts.

Some results obtained with the brand of steel which is known as "T. Y. R.," which is an offspring of the "A. W." and is specially made for machining hard materials, viz., nickel, chrome, and high carbon steels, closed-grained gray iron and malleable castings may be cited. This brand of steel working on chrome steel projectiles 12 inches diameter machined 20 and was cutting 14½ hours before it required regrinding. Cutting speed, 17 feet per minute; depth of cut, ¼ inch; feed, 12 cuts per inch.

Another of these tools, cutting old wheel tires in one of our leading railway shops, finished one very hard tire 3 feet 6 inches diameter at a speed of 17 feet per minute. Depth of cut, ⅛ inch; feed, 10 per inch.

When ordinary self-hardening steel was used they had to grind the tool eight times to perform the same work. Difference in time 30 minutes for "T. Y. R." tool, 2½ hours for ordinary self-hardening tool.

A development of high-speed work, which was not at first looked for, has been in the manufacture and use of twist drills. Many attempts have been made to produce twist drills from ordinary self-hardening steel with usually very indifferent success. Now, however, twist drills made of high-speed steel are a practical success, and are largely in use. To those who are not acquainted with the working of these drills the results obtained from them will be interesting.

An "A. W." twist drill of 1 inch diameter working on steel plates of 2 inches thickness at 250 revolutions per minute, and 5 inches feed per minute, generally drills 150 holes without regrinding.

The following is a comparison between a high-speed drill and an ordinary twist drill: Drilling on gun cradles of 5 inches thickness an ordinary American twist drill did eight holes only and failed, the end being completely burnt up, while an "A. W." drill did 124 holes at the same speed and feed without suffering any injury whatever. The drills were 2 inches diameter, running at 80 revolutions per minute, and each hole was drilled in 6 minutes.

Figs. 3 and 4 show one of our radial drilling machines with the feed gear as originally made and as modified for use with drills of high-speed steel.

The high-speed drills are equally efficient when used on gray iron, performing two or three times the work accomplished by ordinary twist drills, as for instance: At the works of Messrs. Alfred Herbert, Ltd., an "A. W." twist drill of 1 inch diameter drilled thirty holes through a 3-inch gray-iron block, each hole being drilled at the rate of 7¼ inches feed per minute, the drill being uninjured.

The finishing qualities of high-speed steel have also been a matter of some contention, but there is abundant evidence that it will cut at high speeds and yet give a splendid finish at the same time. In support of this the author may refer to a visit recently paid to the works of Messrs. Alfred Herbert, Ltd., at Coventry, and the finish obtained at high cutting speeds there seen was a revelation. The most excellent finish possible is obtained by them in their very ingeniously designed machinery, and when taking one cut only; and their system, and the working of their machinery in conjunction with the high-speed steel, is indeed a tribute to the development of thoroughly up-to-date engineering and rapid production of work bearing a high standard of accuracy.

We must feel that we are only in the early stages of the manufacture and use of high-speed steel and that nothing approaching finality has been arrived at. When the steel maker looks at the innumerable alloys of whose behavior and proportions when mixed with steel, so much has yet to be learned, and also to the infinite number of combinations and per-

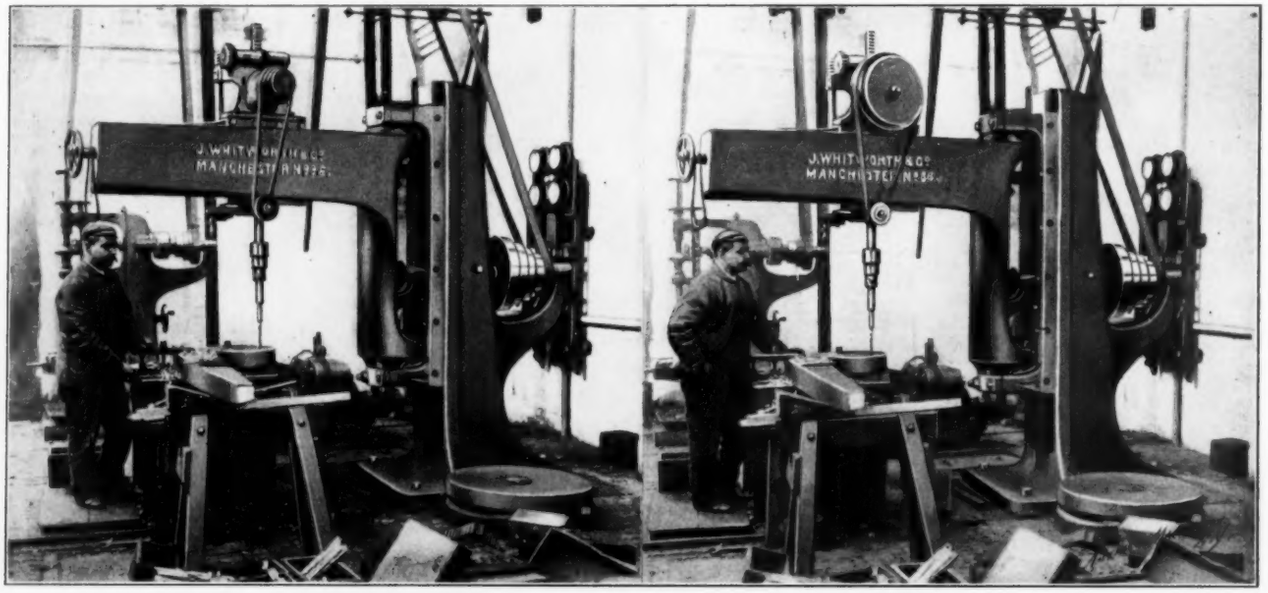


FIG. 3. RADIAL DRILL WITH THE ORIGINAL FEED GEAR.

FIG. 4. RADIAL DRILL WITH FEED GEAR MODIFIED FOR USE WITH HIGH-SPEED STEEL DRILLS.

centages of those alloys with steel, and the corresponding varied results obtained, it is easily seen what a large field of research there is yet to traverse.

(Concluded next week.)

Molding Machines.*

The value of a foundry foreman to his employers depends almost entirely upon his efficiency in three directions: First—his ability to work in perfect harmony with his men, and to secure from them their very best services; second—his ability to turn the work out by the time and in the order required, providing other conditions will permit; and third—his ability to produce the best castings at the lowest cost, and there is no appliance or equipment that can be placed in the foundry which will as effectually assist him in this last named direction as the molding machine. This may not be generally known, but it is nevertheless a fact which is being demonstrated in many of the up-to-date foundries throughout the United States, and especially in our own city.

The advantages over hand work resulting from the use of molding machines are: First, increase in output, and second, the superior quality and uniformity of the castings. In the average jobbing and machinery foundries machine-molded castings can be delivered to the machine shop at just one-quarter the cost [labor cost?—Ed.] of the same castings, if molded by hand; for, in addition to the saving in the cost of molding, there is also a great saving made in the cost of cleaning and finishing, for castings made on machines require practically no chipping nor filing, a little milling making them perfectly clean and ready for use.

When contemplating the introduction of machines, there are several points which should receive the most careful consideration; such, for instance, as durability, simplicity and accuracy, which three combined effect efficiency. From experience I find that the draw plate machine, when fitted up properly, is very well adapted for the general run of foundry work. Patterns and plates for these machines can be made of either wood or iron, depending upon the number of castings required. Wooden patterns and plates give excellent service and can be very easily and rapidly prepared. A little explanation of this method of fitting up the machines may be useful to those who are interested.

Both patterns and plates should be made of close grained, well seasoned hardwood. The cope and drag of the pattern should be temporarily fastened and trued up together at the parting, to insure perfectly corresponding outlines. The stripping plates should be composed of strips of wood about 6 inches wide, the thickness depending on the size of the machine to be fitted. These strips should be glued together, the grain of the wood being reversed for ends and sides, to eliminate all possibility of shrinking, corrugated fasteners being driven across the joints to give additional strength. The first wooden plate should be planed and fitted with pins for the flask, the outline of one-half of the pattern should be marked upon it in its proper position and the plate cut out around this line. Pattern supports, made of well seasoned pine, are screwed to the yoke of the machine. The stripping plate is temporarily fastened to its machine and the pattern dropped through the opening and screwed on to the pattern supports.

To fit up the other half pattern to conform to the pattern and plate already made, the first stripping plate is removed from its machine and laid upon the unfinished plate, the pins in one fitting into holes drilled in the other. The opening in the first plate is carefully marked upon the second, which is then cut out; in this way the openings in the plates are made exactly alike. Both plates are next fastened to their respective machines, the second pattern is dropped through the opening in its stripping plate and screwed to the pattern supports. By this method the whole operation of mounting patterns, whether of the simplest or most complex nature, is performed without the use of a scale or measurement of any kind, and the patterns are located so perfectly that there will be no offsets of any kind on the castings. Gate forming pieces are screwed to the stripping plates, and sprues with telescoping buttons are used so that when the sand is struck off from the cope this piece can be taken out, leaving a perfectly formed sprue.

To illustrate the durability of these wooden patterns and plates I would say that I have in the foundry machines that were fitted up over two years ago. Hundreds of castings have been made from them, yet they are now in as good condition as the day they were sent down to me. I know, too, from experience that a pattern fitted in a machine will outlast three hand patterns, which are soon rendered worthless by the continuous rapping which they receive.

The cost of making patterns and plates for the machines depends almost entirely upon the nature of the work. On an order for castings requiring three days to be molded by hand, the patterns can be fitted up in the machines, and the cost of molding the castings and making the patterns and plates, including the cost of materials used, will not equal the cost of the three days' work of molding by hand, so that after the third day the saving effected by increased output and the use of cheaper labor is a clear gain. If the pattern is one that is run either continually or at intervals the outfit of stripping plates and patterns must be considered in the light of an equipment and not an expense. The average saving in the actual cost of molding which the draw plate machine is able to effect I find runs from 50 per cent. to 60 per cent., altho from my own experience I know that greater savings than these can be made.

By far the best results can be obtained from the machines when operated by ordinary laborers. A laborer learns thoroughly how to do just one thing, and that he does quickly and efficiently. His ignorance in other directions is an assistance and not a hindrance to him; for a floor molder, if his mold drops, starts at once to patch it, whereas the machine operator not knowing how to do this, shakes the mold out and rams it up again in less than half the time that it takes the molder to patch his. A machine operator will also set cores in the one way which has been taught him much quicker than a molder will, who always has his own ideas as to how things should be done.

A few words regarding the utility of the machine I think will be quite interesting to some of us. Only a few years ago we considered that their usefulness was limited to flasks up to about 18 inches, but gradually their scope became broader and broader, until to-day we are building machines for molding castings weighing 13,000 pounds; these machines weigh about 2 tons each and will take flasks 5 feet by 10 feet. Machines for molding castings such as large dynamo beds and boiler sections measuring up to 60 inches in width, flywheels 60 inches in diameter and electrical machinery parts requiring draws of 28 inches, are being installed throughout the country by all the well-known manufacturers of these different lines. An interesting case has just been brought to my attention of a foundry in which a set of the large machines mentioned above have recently been installed for molding some patterns from which only three castings were required, which speaks volumes for the utility of the machine, when there is not the heretofore considered necessary great duplication of work to be made. These large machines are being operated quite extensively now as turn-over machines. They are fitted on the sides with trunnions, so that after the drag mold has been rammed up the machine is lifted by a quick-acting crane, turned right over, the pattern is drawn upwards and the machine and pattern returned to their original position. This you will see obviates the necessity of barring the drag flask, and in the case of an exceedingly complicated pattern having deep pockets to be molded, a perfect mold is insured, which might not be obtained if the flask were lifted from the machine and turned over according to the usual method.

* From a paper read before the Chicago Foundry Foremen's Association, by George C. Nielsen.

United States Consul Frank H. Mason writes from Berlin that there is a "demand" in Germany for steam-driven gang-saw mills for logs round or squared up to 24 or 30 inches diameter. Portable mills also are wanted for use on forest tracts. Circular saws of large size are little used.

Notes on Rope Transmission.

BY E. A. REULEAUX.

The following notes and tables refer to the so-called American system of rope-transmission only, which, as the reader understands, employs only one continuous rope, which, running over a self-adjusting tension or tightener system, is wrapped as often around driver and driven as will be required to transmit the desired horse-power, securing nearly complete adhesion and absence of slippage. They are intended to serve *only* as a preliminary guide for parties desiring to use this kind of transmission in their works, since each particular case depends on local conditions, which will always differ in more or less important details, and also because other points not touched upon herein, such as slag of rope, arc of contact, angle of pullev and coefficient of friction, are to be taken into consideration, which require the most careful study of an expert engineer in this particular line in order to make the rope drive an absolute success, both mechanically and financially.

Table 1 gives in its first and last columns the commercial sizes of manila ropes preferably used in rope drives; in its second column their weights per 100 fathoms in pounds, while the third and fourth columns show their approximate weight per 100 feet in pounds and the number of feet in each pound. Column 5 gives the ultimate strength of a new rope, while column 6 contains the economical working strain to be recommended, *i. e.*, 2 per cent. of the ultimate strength, an apparently low percentage but one that insures a longer life for the rope, which, as can readily be understood, is subject to much more bending strain and considerably more inside and outside wear than a belt, because of its extensive use in angle drives and long distance outdoor service. For the same reason it must also be recommended not to use sheaves less than forty times the diameter of the rope. In extreme cases of necessity this ratio can be made as low as 30, but always to the detriment of the life of the rope.

Size diameter in inches.	Weight 100 fath. in lbs.	Weight* 100 feet in lbs.	Number of feet in a pound.	Ultimate Strength in lbs.	Economical work. strain in lbs. †	Size diameter in inches.
½ in.	46	9.5	13 ft. 0 in.	2,250	45	½ in.
⅝ "	80	16	7 " 6 "	4,000	80	⅝ "
¾ "	98	20	6 " 0 "	5,000	100	¾ "
⅞ "	142	30	4 " 3 "	7,500	150	⅞ "
1 "	170	34	3 " 6 "	9,000	180	1 "
1⅛ "	230	42	2 " 7 "	12,250	245	1⅛ "
1¼ "	271	50	2 " 3 "	14,000	280	1¼ "
1½ "	390	70	1 " 6 "	20,250	405	1½ "
1¾ "	581	112	1 " 0 "	30,250	605	1¾ "
2 "	678	130	0 " 10⅔ in.	36,000	720	2 "
2¼ "	920	170	0 " 7⅔ "	49,000	980	2¼ "
2½ "	1,106	192	0 " 6½ "	56,250	1,125	2½ "

* Approximate. † Economical working strain =2% of ultimate strength.

TABLE 1. WEIGHT AND STRENGTH OF MANILA TRANSMISSION ROPES.

Table 2 gives the horse-power transmittable by a rope drive can be defined by the following formula:

$$\text{H.P.} = \frac{V \times N \times W}{33{,}000}$$

in which V = velocity of rope in feet per minute, N = number of wraps, and W = economical working strain from Table 1.

On the basis of this formula Table 2 has been gotten up, which covers the same range of ropes from ½ inch to 2½ inches as Table 1, and gives in its first and last columns the diameters of the sheaves from 20 to 120 inches, advancing by 2 inches from 20 to 32 inches, by 4 inches from 32 to 48 inches, and by 6 inches from 48 to 120 inches, while column 2 gives the rope speed in feet at 100 revolutions per minute, columns 3 to 14 containing the horse-power at this speed over sheaves of from about 40 to 80 times the diameter of the rope. Experience has taught us that the most economical rope speed, neglecting wear, is around 5,000 feet per minute, and column 15 gives therefore the corresponding revolutions per minute to obtain this most economical speed.

To make a general recommendation as to the most economical size of rope is nearly impossible, as conditions for individual cases vary so extensively. As the driving force varies in proportion to the square of the rope diameter, one wrap of a 2-inch rope would be equivalent to four wraps of 1-inch rope. Local conditions might make the use of the latter necessary, altho the smaller rope would naturally give out somewhat earlier, being subjected to more surface and internal wear. In a case like this it would be recommendable to use, if possible, a sufficient or even excessive number of wraps of an intermediate size rope between the two mentioned, say three wraps of 1¼-inch or two wraps of 1½-inch rope. The

Diam. of sheave, inches.	Speed in ft. at 100 Rev. per min.	SIZE OF ROPE.												Economical Revolutions per min.	Diam. of sheave, inches.
		½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1⅛ in.	1¼ in.	1⅜ in.	1¾ in.	2 in.	2¼ in.	2½ in.		
20	523.9	.714	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	954	20
22	576.0	.785	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	868	22
24	628.1	.857	1.523	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	795	24
26	680.2	.928	1.650	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	734	26
28	733.3	.999	1.777	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	681	28
30	785.4	1.071	1.900	2.380	. .	. .	. .	. .	. .	. .	. .	. .	. .	636	30
32	837.5	1.142	2.030	2.538	. .	. .	. .	. .	. .	. .	. .	. .	. .	597	32
36	942.7	1.285	2.285	2.857	4.285	. .	. .	. .	. .	. .	. .	. .	. .	531	36
40	1046.8	1.428	2.538	3.172	4.758	5.709	. .	. .	. .	. .	. .	. .	. .	477	40
44	1152.1	. .	2.792	3.491	5.236	6.284	8.554	. .	. .	. .	. .	. .	. .	441	44
48	1256.2	. .	3.045	3.806	5.709	7.154	9.325	. .	. .	. .	. .	. .	. .	398	48
54	1413.5	. .	. .	4.283	6.425	7.710	10.491	11.909	. .	. .	. .	. .	. .	358	54
60	1570.8	. .	. .	4.760	7.140	8.568	11.662	13.325	19.278	. .	. .	. .	. .	318	60
66	1728.1	. .	. .	. .	7.854	9.433	12.828	14.661	21.260	. .	. .	. .	. .	290	66
72	1884.4	. .	. .	. .	8.565	10.279	13.991	15.989	23.133	34.547	. .	. .	. .	265	72
78	2041.7	. .	. .	. .	. .	11.138	15.160	17.325	25.597	37.415	. .	. .	. .	244	78
84	2198.9	. .	. .	. .	. .	11.998	16.333	18.663	27.000	40.327	47.991	. .	. .	227	84
90	2356.3	. .	. .	. .	. .	. .	17.491	19.992	28.915	43.193	51.404	69.975	. .	212	90
96	2513.5	. .	. .	. .	. .	. .	. .	21.325	30.845	46.077	54.836	74.637	. .	199	96
102	2669.7	. .	. .	. .	. .	. .	. .	22.650	32.764	48.944	58.248	79.282	91.012	187	102
108	2827.1	. .	. .	. .	. .	. .	. .	. .	34.606	51.830	61.561	83.956	93.378	177	108
114	2984.4	. .	. .	. .	. .	. .	. .	. .	36.627	54.714	65.114	89.234	101.741	167	114
120	3141.7	. .	. .	. .	. .	. .	. .	. .	38.588	57.658	68.546	99.359	107.109	158	120

Angle of groove, 45°; arc of contact, 165°.

TABLE 2. HORSE-POWER OF ROPE DRIVES PER WRAP AT 100 REVOLUTIONS PER MINUTE.

question of using a large number of wraps of a smaller size rope in preference to a small number of wraps of a larger size depends often also on the weight, etc., of the necessary sheaves as a first-cost item, besides that local conditions as to clearance above and underneath and space allottable on the respective shafts will form a determining feature, while the cost of the different ropes will be practically almost the same. The cost of the smaller but wider faced sheave for a smaller rope and that for the larger, but narrow faced one for a larger rope will in some instances be almost the same, in which case practise teaches us that the larger size rope is always preferable, other conditions permitting.

Table 3 is to be used in roughly calculating the general dimensions of rope sheaves, the first and last columns giving again the rope sizes. Column 2 gives the amount to be added to the nominal or pitch diameter, in order to arrive at the actual outside diameter of the sheave, the nominal or pitch diameter being that of a circle passing through the points of contact between the rope and the side of groove angle. Columns 3 and 4 furnish approximate dimensions for the distances from center to center of the grooves, and those from center of groove to the outside edge of sheaves. Thus a 48-inch eight-groove sheave for 1¼-inch rope will have an actual outside diameter of 48″ + 2 9-16″ = 50 9-16″, and a total width of 7 × 1⅞″ + 2 × 1 5-16″ = 15¾″.

Diameter of rope in inches.	Add to pitch diameter, inches.	Distance center to center of grooves.	Distance center of groove to outer edge.	Diameter of rope in inches.
½ in.	1 1/16 in.	¾ in.	9/16 in.	½ in.
5/8 "	1 5/16 "	15/16 "	11/16 "	5/8 "
¾ "	1 9/16 "	1⅛ "	13/16 "	¾ "
⅞ "	1 13/16 "	1 5/16 "	15/16 "	⅞ "
1 "	2 1/16 "	1½ "	1 1/16 "	1 "
1⅛ "	2 5/16 "	1 11/16 "	1 3/16 "	1⅛ "
1¼ "	2 9/16 "	1⅞ "	1 5/16 "	1¼ "
1½ "	3 1/16 "	2¼ "	1 9/16 "	1½ "
1¾ "	3 9/16 "	2⅝ "	1 13/16 "	1¾ "
2 "	4 1/16 "	3 "	2 1/16 "	2 "
2¼ "	4 9/16 "	3⅜ "	2 5/16 "	2¼ "
2½ "	5 1/16 "	3¾ "	3 9/16 "	2½ "

TABLE 3. GENERAL DIMENSIONS OF SHEAVES.

With these three tables as a guide, preliminary calculations can be made as to the proposed arrangement of a proposed rope drive to suit any local conditions, which, of course, as stated above, should be laid before an expert rope-drive engineer for his examination and approval, before going ahead with the actual installation.

A few examples will explain the use of the tables:

1. Jackshaft in engine-room runs 400 revolutions per minute, and it is desired to transmit, in an unobstructed horizontal line of 150 feet center to center, 175 horse-power to main line in machine shop, which, driven now by an independent engine, shall retain its present speed of 240 revolutions per minute. Space available in width on main line, 18 inches; drop of hangers, 24 inches on 4x10-inch footing pieces; therefore the clearance above center of shaft is 28 inches maximum; largest possible sheave, 54 inches diameter. From Table 2 we find under 54-inch sheave and ⅞-inch rope 6.425 horse-power transmitted by one wrap at 100 revolutions per minute. Multiply this figure by 2.4 and by 12, resulting in 185 horse-power, which is 6 per cent. over the amount required. From Table 3 we find the actual outside diameter of the sheave to be 55 13-16 inches, and its total width 11 × 1 5-16″ + 2 × 15-16″ = 16 5-16″, and from Table 1 that the drive will require 4,000 feet, or 1,200 pounds, of ⅞-inch rope, due allowance being made for the amount necessary for the tightener system. For 1-inch rope we get 10 wraps, transmitting also 185 horse-power, 56 1-16 inches outside diameter of sheave, 15⅝ inches total width, while we will require about 3,400 feet, or 1,156 pounds, of 1-inch rope. The same calculations for 1⅛-inch rope result in 177 horse-power transmitted by seven wraps; outside diameter of sheave, 56 5-16 inches; total width, 12½ inches; amount of rope required, 2,500 feet, or 1,050 pounds; rope speed in each case, 3,532 feet.

2. In an installation in a new shop, where the power transmission is taken into consideration before the building details are finally decided, it is possible to lay out a rope drive in such a manner as to get nearly the most economical rope speed. Again assume 240 revolutions per minute for the driven shaft and 320 horse-power to be transmitted, using 78-inch sheaves throughout, the jackshaft being located near the floor line of the engine-room and the drive running up to a rope tower about 30 feet above the jackshaft, over idler sheaves to the driven sheave on the main line at about 100 feet distance. We get from our tables:

For 1-inch rope,
12 wraps, 320 H.P., 3,900 ft., or 1,326 lbs. of rope.
For 1⅛-inch rope,
9 wraps, 327 H.P., 3,100 ft., or 1,302 lbs. of rope.
For 1¼-inch rope,
8 wraps, 336 H.P., 2,800 ft., or 1,400 lbs. of rope.
For 1⅜-inch rope,
5 wraps, 307 H.P., 2,000 ft., or 1,400 lbs. of rope.
For 1½-inch rope,
4 wraps, 359 H.P., 1,700 ft., or 1,804 lbs. of rope.

Of these 1¼-inch or 1⅜-inch would be the most recommendable sizes, as five 1½-inch wraps would not give enough power, while six wraps would considerably overrun the required amount. Four wraps of 1¾-inch rope also overrun this amount, and the cost of rope and sheaves would be too much in excess of that for the smaller sizes.

3. As a third example we will take a multiple-drive into contemplation—*i. e.*, an arrangement by which, for instance, from the jackshaft located in the basement of a six-story manufacturing plant, power is to be delivered to each story by means of one continuous rope. Of a total of 300 horse-power is to be delivered:

To 1st story	.....	110	H.P. at	300 R.P.M.
To 2d "	.....	65	"	250 "
To 3d "	.....	40	"	225 "
To 4th "	.....	26	"	200 "
To 5th "	.....	16	"	175 "
To 6th "	.....	7	"	150 "

Selecting ¾-inch rope and a uniform sheave size of 36 inches, we require thirteen, nine, seven, five, four and two wraps for the desired power in the different stories, the main driving sheave in basement having a total of forty grooves and a width of 45½ inches over all; while if we select ⅞-inch rope and 40-inch sheaves we need eight, six, four, three, two and one wrap, the main driver being 32 1-16 inches wide for a total of twenty-four grooves. The former rope requires about 4,800 feet, or 960 pounds, of ¾-inch rope, against 2,900 feet, or 870 pounds, of ⅞-inch rope, about 250 feet being allowed in each case for the tightener system, while the distances from center to center of the shafts have been assumed at the uniform figure of 20 feet.

As on the proper design and location of the tightener system the very life and success of the American rope drive depends, I take, in conclusion, one more occasion to strongly advise the consultation of an expert rope-drive engineer who, as a specialist in this line, can be depended on to make the installation a "go."

Cleveland, O.

Success of the American Hair Puller.

United States Consul Marshal Halsted writes from Birmingham that the American hair puller is a success. "English rabbit skins are now shipped to the United States direct instead of being sent to the continent of Europe, where formerly the long hairs, used in the manufacture of felt hats, were pulled by cheap hand labor before going to the United States, the American unhairing, or pulling, machine having proved to be a success. The American cutters of fur think it more advantageous to pull their own skins by these machines, as in doing so they retain all the pieces, waste hair, etc., which were formerly retained by the Belgian pullers."

A Screw-Thread Angle Table.

BY GEO. L. COLBURN.

The accompanying table gives the angle of helixes of various pitches and diameters with respect to a line perpendicular to the axis. These angles were worked out with the idea of using them for grinding thread tools for threads of various pitches upon different diameters of work. This table will enable one to set the protractor at the proper angle of side clearance for the work in hand and grind the thread tool correctly without guesswork.

Figs. 1 and 2 show side and front elevations of the thread tool and of the protractor as applied to obtain the proper angle of side clearance to cut a right-hand screw thread. The front edge of the thread tool is used to determine the angle of side clearance. Fig. 3 shows a section taken along the line $a\,b$, Fig. 1. It will be noticed that line $e\,f$ is shorter than $G\,H$ to give clearance to the cutting edges of the thread tool and also that $G\,R$ is equal to $H\,R$ and $e\,S$ is equal to $f\,S$. The angle of the helix at half the depth of the thread, Fig. 4, can be used, if desired, and can be approximated to from the table, or figured exactly by the method given at the top of the table.

While the table is worked out for single threads, it can be used for double or triple threads by considering the lead equal to the advance of the work in one revolution instead of $\frac{1}{p}$, as given in the table.

It is customary in many shops to have several thread tools in stock to cut these various thread angles, each cutting within a certain range of angles. The table will be useful in determining the best range for each thread tool. We have had this table in use for more than a year, and find that by grinding the thread tool to the angle of helix for the pitch and diameter of work selected, we are able to cut very smooth, accurate screw threads.

P = Pitch = Threads per inch. $\frac{1}{P}$ = Lead = L

D = Diameter of Work in inches. $\pi = 3.1416 = \frac{C}{D}$

C = Circumference of Work in inches = πD

$\frac{L}{C} = \frac{\text{Lead}}{\text{Circumference of Work}} = \frac{\frac{1}{P}}{\pi D}$ = Tangent of Angle

Find Angle in Table of Tangents

THREADS PER INCH = P

Diameter of Work	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32
¼″	50°-54′	32°-31′	22°-59′	17°-39′	14°-18′	11°-59′	10°-19′	9°-2′	8°-3′	7°-58′	7°-11′	6°-3′	5°-36′	5°-12′	4°-51′	4°-33′	4°-3′	3°-39′	3°-19′	3°-1′	2°-45′	2°-30′	2°-25′	2°-17′
⅜″	40°-23′	23°-1′	15°-48′	12°-16′	9°-39′	8°-8′	7°-13′	6°-37′	5°-20′	5°-30′	4°-49′	4°-24′	3°-45′	3°-28′	3°-14′	3°-3′	2°-43′	2°-26′	2°-13′	2°-1′	1°-53′	1°-44′	1°-37′	1°-31′
½″	32°-30′	17°-41′	11°-58′	9°-3′	7°-16′	6°-37′	5°-40′	4°-33′	4°-3′	4°-1′	3°-37′	3°-3′	2°-49′	2°-36′	2°-26′	2°-17′	2°-2′	1°-49′	1°-40′	1°-31′	1°-24′	1°-18′	1°-13′	1°-8′
⅝″	27°-2′	14°-18′	9°-38′	7°-15′	5°-49′	5°-8′	4°-10′	3°-52′	3°-15′	3°-13′	2°-54′	2°-36′	2°-12′	2°-5′	1°-57′	1°-48′	1°-37′	1°-28′	1°-20′	1°-13′	1°-8′	1°-3′	59′	54′
¾″	23°-5′	12°-1′	8°-8′	6°-4′	4°-52′	4°-3′	3°-52′	3°-3′	2°-43′	2°-41′	2°-19′	2°-2′	1°-53′	1°-44′	1°-37′	1°-31′	1°-21′	1°-13′	1°-7′	1°-1′	57′	53′	49′	46′
⅞″	20°-4′	10°-20′	7°-1′	5°-12′	4°-10′	3°-[illegible]′	2°-59′	2°-37′	2°-19′	2°-18′	2°-4′	1°-50′	1°-37′	1°-30′	1°-24′	1°-18′	1°-10′	1°-3′	57′	53′	49′	45′	42′	39′
1″	17°-39′	9°-2′	6°-2′	4°-53′	3°-39′	3°-2′	2°-36′	2°-17′	2°-2′	2′	1°-48′	1°-31′	1°-24′	1°-18′	1°-13′	1°-8′	1°-1′	55′	50′	45′	42′	39′	36′	34′
1⅛″	15°-49′	8°-4′	5°-23′	4°-1′	3°-15′	2°-[illegible]′	2°-19′	2°-2′	1°-48′	1°-47′	1°-36′	1°-21′	1°-15′	1°-11′	1°-5′	1°-1′	54′	49′	45′	40′	38′	35′	32′	30′
1¼″	14°-10′	7°-12′	4°-48′	3°-39′	2°-55′	2°-26′	2°-2′	1°-50′	1°-44′	1°-37′	1°-27′	1°-13′	1°-7′	1°-3′	59′	54′	49′	44′	40′	37′	34′	31′	29′	27′
1⅜″	13°-4′	6°-37′	4°-25′	3°-19′	2°-40′	2°-13′	1°-54′	1°-36′	1°-29′	1°-28′	1°-19′	1°-6′	1°-1′	57′	53′	50′	44′	40′	36′	33′	31′	28′	27′	25′
1½″	11°-59′	6°-4′	4°-3′	3°-3′	2°-26′	2°-2′	1°-44′	1°-31′	1°-21′	1°-20′	1°-13′	1°-1′	56′	52′	49′	46′	40′	36′	33′	30′	28′	26′	24′	23′
1⅝″	11°-6′	5°-36′	3°-44′	2°-49′	2°-15′	1°-52′	1°-36′	1°-21′	1°-15′	1°-14′	1°-7′	56′	52′	48′	45′	42′	37′	34′	31′	28′	26′	24′	23′	21′
1¾″	10°-26′	5°-16′	3°-29′	2°-37′	2°-5′	1°-44′	1°-29′	1°-18′	1°-10′	1°-8′	1°-2′	53′	48′	45′	42′	40′	35′	31′	28′	26′	24′	22′	21′	19′
1⅞″	9°-39′	4°-52′	3°-15′	2°-26′	1°-57′	1°-37′	1°-23′	1°-13′	1°-5′	1°-4′	58′	49′	45′	42′	39′	37′	33′	29′	27′	24′	23′	21′	19′	18′
2″	9°-4′	4°-34′	3°-3′	2°-18′	1°-50′	1°-31′	1°-18′	1°-8′	1°-1′	1°-0′	54′	47′	42′	40′	36′	34′	31′	27′	25′	22′	21′	19′	18′	17′
2¼″	8°-8′	4°-9′	2°-42′	2°-2′	1°-37′	1°-21′	1°-8′	1°-1′	54′	53′	49′	41′	37′	35′	32′	30′	27′	24′	22′	20′	19′	18′	16′	15′
2½″	7°-15′	3°-39′	2°-26′	1°-49′	1°-28′	1°-16′	1°-3′	55′	49′	48′	43′	37′	34′	31′	29′	27′	24′	22′	20′	18′	17′	15′	14′	14′
2¾″	6°-37′	3°-19′	2°-13′	1°-40′	1°-22′	1°-7′	57′	50′	45′	44′	40′	33′	31′	28′	26′	25′	22′	20′	18′	17′	16′	14′	13′	13′
3″	6°-4′	3°-3′	2°-2′	1°-31′	1°-13′	1°-1′	52′	46′	41′	40′	36′	30′	28′	26′	24′	23′	20′	18′	17′	15′	14′	13′	12′	11′

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THREAD ANGLE TABLE.

The Growth of the Modern Machine Tool.

It was about 1870 that the first manufacturing machine tools were built in any extensive lots and varieties, and from that time there has been a steady increase in the building of a variety of machine tools for doing an increased amount of work on a particular type of piece to be machined, and a proportionate decrease in the building of machines for a general variety of work. The combination machine tool for a large variety of work has

come to be considered in most cases as the manufacturer's abomination.

The machine-tool builder has the advantage over the builders of general machinery since he puts to a practical test in his own shop the types of machines which he builds. An enterprising machine-tool plant is an experimental laboratory which makes repeated tests, improvements, and refinements which are of equal benefit to manufacturer and purchaser.

The three potent factors which are revolutionizing the design of machine tools are: independent motor drives, high cutting speeds with air-hardening tools, and modifications in the *modus operandi*.

About a decade ago we began to hear and read the discussions of machine-tool builders on differentiation of shop costs and systems, since a few leaders of the trade had become convinced that better systems in every aspect of shop management would have to be provided. In the analysis of a system it was soon apparent that the unit system of drive was the starting point, and there soon developed the unit system of independent machine motor and motor group drives. The electric motor was naturally the one selected but the type of motor and the ways and means for feeding the current to it is in a state of evolution. The type of motor which will eventually be used cannot be exactly foretold.

The conditions to be satisfied in an independent motor drive are apparently indicated thus: It must be an infinitely variable speed motor, commutatorless, of slow speed, fed with high-pressure current, and equipped with an electrical brake to bring quickly to rest its high-speed rotating parts. Ideally, a motor is demanded that will give all the variable changes of speed without reducing gears, and with its rotating parts properly journaled in the bearings occupied by the usual spindle. There is at present on the market a variable-speed motor without back gearing which can be directly used with high speed air-hardening cutting tools when cutting within limited ranges of speed. Some time will probably elapse before the electrical engineers will be able to economically design the abnormally slow-speed motor that is demanded in turning pieces of large diameter, and until then we will have to be content with reducing gears for slow speeds. In this connection it is *apropos* to remark that they should be so arranged as to drive the front spindle gear from the front instead of from the rear, as is usually the case, the driving effect of the gear being directed toward the bottom of the box and opposite to the lifting effect of the tool when cutting.

There has been considerable discussion in regard to systematizing and standardizing speeds for the various materials and tabulating them on a plate which is attached to the machine for reference by the operator, and from it the proper speeds are set with a tachometer. The spirit of system is commendable, but in this case it is possibly a refinement in the wrong direction, for the metals cut will have varying degrees of hardness and other properties which affect the cutting action of a tool, and a machine is not working at its maximum efficiency unless it is driven at its maximum speed and feed. The operators of a modern machine-tool shop should be modernly skilled men who are able to set the maximum speeds for their tools without a tachometer, but they should be supervised by a foreman who can act as the speed indicator for a number of men.

When very heavy and large work has to be operated upon, it is much more convenient and expeditious to walk the machine tool over the work than to turn the work over and under the tool, and this has brought out a new species of machine tool which is fast developing and which is known as the portable machine tool. For the successful design and operation of this class of tool the variable-speed motor described above is indispensable.

Besides the general use of the current for driving motors on tools, cranes, etc., it has been applied to energizing magnets for securely confining thin and awkward pieces of work which have to be finished plane and true on a part or on all of their surfaces. These attachments, which are known to the trade as "Walker's Magnetic Chucks," bid fair to be another factor in revolutionizing the design of machine tools, since the holes and slots of the tables of planers, millers, grinders, etc., will be almost entirely eliminated, and there will also be a gain in stronger, stiffer, simpler, and lighter tools.

The most important and aggressive agent in the forcing of the introduction and installation of the electric motor for independent drive is the air-hardening high-speed steels. The electric motor, after being well introduced as a strong ally of the unit system, has multiplied its usefulness several times by taking in tow the air-nardening high-speed cutting tools. When these steels are worked to their maximum capacity the service of belts for power transmission can no longer be used to the best advantage. It appears from practise trials of considerable duration that the high-speed steel can be driven easily and regularly at quadruple the speed of the ordinary carbon steel and double the speed of Mushet steel. This probably means that we shall have to drive our machines with quadruple the power used with the common steels. However, from the results of other tests, it has been found that a great deal more than the proportionate power was needed, which was probably due to the flimsiness of the machines upon which the tests were made.

It is claimed by a responsible authority who made tests with 30-point carbon steel that a cutting speed of 175 feet per minute is a practicable working speed and that the destructive speed for the tool is 425 feet per minute. It has also been stated by a few authorities that the normal cutting speeds could be taken within 10 per cent. of the destructive speeds, but the expansion of the work due to excessive heat forbids it. If, then, this information is reliable, we have not begun to reach the limit of the speeds and will not be able to do it until adequate provision is made for cooling the tool and work. For this provision what is more reasonable, from the nature of the beast, than to draw on all out of doors for the free and abundantly available supply of surrounding air. Of course it is no new experiment to use compressed air for a lubricant, but, instead of a comparatively thin pencil of compressed air directed against the edge of the tool, why not draw the air over the work and tool by suction through a funnel? Incidentally, by so doing, we could remove through the same duct the injurious scale dust, gray-iron dust, and hot steel chips, and, at the same time, automatically and continuously clean the machine. This arrangement could also be used for a ventilating system for the shop.

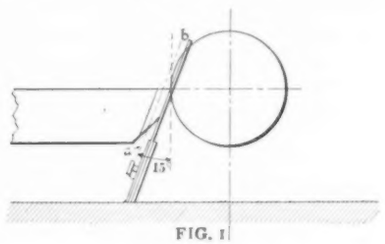

FIG. 1

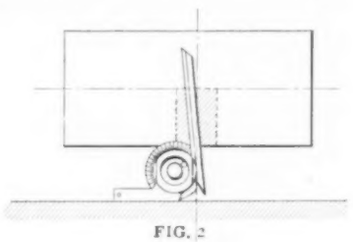
FIG. 2

FIG. 3

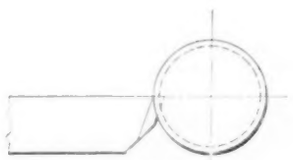
FIG. 4

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THE USE OF THE PROTRACTOR.

No argument is needed to convince the users of the high cutting speed steels that much heavier supports for the tools and work must be provided. As the work and tool become more rigidly confined and supported, the number of cutting tools attacking the piece to be machined will multiply and the spirit of design in high duty operating tools will be to clean and finish the work in one traverse. In fact the multiple cutting principle is becoming predominant for paring off metal, bedding-in fits and polishing to a smooth surface.

Cumbersome and inefficient multiple-stroke planers with the ear-piercing screech of reversing belts are doomed to be entirely replaced by the seductively singing motor-driven monostroke miller. Coarse and fine pitched threads of all types and sizes can no longer be subjected to the old-time methods of chasing by repeated drives of the traditional single-pointed thread tool, but must be pared and polished with the more uniform accuracy of the angular thread milling tool, and inaccurately machined chilled castings and heterogeneous material should no longer be accepted when it is indisputably proven that the work of the multiple cutting points of the corundum and carborundum wheels give far better results in a much shorter time.

When only a comparatively few of the points on a circular multiple cutting tool are cutting, it has been noted that particularly in the air-hardening steels there is a bad effect from expansion and contraction due to sudden heating in cutting and too long cooling when not cutting. This apparently indicates a necessary modification in the methods of designing and operating multiple cutters, which modification should apparently be established on the principle that all cutting points should be continuously engaged at the same time.

More elaborate equipment and improved methods in foundries, more improved dies and forging methods, and more accurate gaging and finishing of the rolling mill product will provide for far less machining and will save the skin of many a casting with the result that the machine can be made much stiffer and lighter.

With the more efficient slow-speed motors; with the increasing speeds of the fast cutting tools; with the multiple cutters working in unison on monostroke machines; with the stiffening effects of unskinned castings, rolled bars, and plates, and with an adequate and economically disposed amount of material for resisting fiber stress, we find a balanced system of forces in remarkably synchronous harmony, and the prophet, when confronted with the foregoing facts and possibilities, could well declare that a revolution in machine-tool design is surely upon us without much notice for preparation, and the crew that can first clear its deck for action can sweep the sea of trade competition.—*From a paper by C. E. Coolidge in The Sibley Journal.*

Factory Fire Departments.

BY R. P. KING.

Some time ago I was visitiing a large manufacturing establishment, and as I passed through the main entrance of the works I saw just inside the door a row of perhaps half a dozen lanterns. They were resplendent in a fresh coat of red paint, with clean globes and apparently in condition for immediate service. Now, while lanterns do not afford any protection from fire, I knew when I saw that row that I should find in this factory more than the ordinary appliances for factory fire protection.

The most effective means for protecting factories are, I suppose, the automatic sprinkler and thermostat systems. Many factory owners and superintendents are not satisfied with the protection afforded by these automatic devices, and other equipment is supplied and departments are organized, sometimes with the idea of increased protection and at others with a reduction in insurance rates in view. By properly handling the matter it is possible to accomplish both of these.

Factory fires not infrequently occur at night, having their origin during the day, perhaps, at the hands of careless workmen, and any such fire after smoldering for hours may break into a blaze but a short time after the watchman has made his hourly round, and by the time the fire is discovered its incipient stage may be past. The watchman in such a case is often in doubt whether to remain and fight the fire or to run for help. Possibly he tries to master the flames with a fire bucket and delays the call for help until too late. Or, perhaps, he hurries to the engine-room to signal for help by blowing the factory whistle and returns to find the fire beyond his feeble efforts.

In my opinion the hourly round of the watchman is not sufficient protection. Each part of the factory should be visited at least once each half hour during the time that the workmen are absent. Not only this, but pattern lofts, storage houses, lumber yards and similar places of hazard should be visited and inspected at regular intervals at all times, irrespective of the workmen who are supposed to be (but often are not) going and coming at all times, but whose regular place of employment is elsewhere. The fact that the factory improvement committee, New England Insurance Exchange, is contemplating certain alterations in its building requirements is a proof that the protection ordinarily given to factory buildings is far from satisfactory.

We may consider, first, the hazard from without. As factories are usually built with a yard, this danger is not as great as is the similar danger that confronts office buildings in the crowded business portions of our great cities. Tin clad shutters, open sprinklers under the eaves of exposed buildings, and fireproof roofs, complete the protection usual for these exposed buildings. The recent great fires seem to condemn the tin-clad shutter and point to the metal sash and armored glass. The watchman should visit these exposed buildings as a part of his regular rounds, his route being arranged to take him through the yards and alleys as best suited to the proper protection of the plant. In case the watchman discovers a fire in the neighborhood of his plant, his first duty is to call for help, the city department if possible, without leaving the grounds, but in no case is he to relax his vigilance in protecting the interests of his employer, which at all times is to be considered his first duty. If the fire should originate within the plant, the watchman's first duty should be to call for help; his next, to try to put out the fire. In the first he should be aided by a system of push-buttons, so that the city or factory department or both can be summoned by the watchman from any part of the establishment. These push-buttons may be located near hose reels or fire buckets, so that no time would be lost in sounding the alarm. Of course there are cases where it would not be necessary to call for aid, and something would have to be left to the judgment of the watchman, but where we consider the precautions taken to discover fire while still in an incipient state, it would be folly to delay the call for help where the only reason against it is the reluctance to break in upon the leisure of a few men.

On board ship men are trained to fight fire by the use of false alarms, which may be rung at any hour of the day or night, until the men are trained to take their stations with the same dispatch and order that attend their other drills. And so with the factory department. A night call, even if the alarm be false, will tell what men can be relied upon and how soon the department can be expected to respond. In fact, it will point out weak features of organization even if it does nothing else.

The master mechanic of the establishment would seem to be the proper person to have charge of the factory fire department. He is, or should be, a man of good judgment, used to dealing with emergencies, and therefore not easily "rattled," and above all, he is thoroughly acquainted with every nook and corner of the whole plant. The men and equipment should be selected by him and he should be held responsible for results in this department just as much as in his regular mechanical work.

The men for the company are not so easily selected. They should be picked men, young or middle aged, acquainted with the shop, and should live within a reasonable distance of the works in order to be ready to respond quickly to a night alarm. Above all, they should be men of the kind whom one invariably finds at home.

Two hours a week is not too much to devote to training these men. The exercises may consist of getting out the hose, coupling joints, climbing ladders, carrying lines of hose through the factory, etc. In

some factories, a salvage corps should be added to the department and should be equipped with tarpaulins to protect stock that might be injured by water. In factories employing women and children, the department should be instructed in the best ways to get the timid ones down fire escapes and to prevent crowding on the stairs. Many other things will suggest themselves to the man in charge. Try to keep the men interested in the drill and provide quarters and equipment that will enable them to take pride in their work.

I have in mind a dark, damp little shed, hardly large enough to house an old home-made hose reel; no tool box on the reel, no straps for play pipes, no lanterns, no axes, no rubber coats, no organization—in fact, nothing but the hose, which was the cheapest in the market. One day the hose was needed and was brought out by volunteers, who hunted up wrenches and play pipe. The water was turned on, only to find that the play pipe had stood in the corner on the earth floor, and the dirt was jammed in the end so tightly that 90 pounds pressure failed to start a leak.

The insurance regulations require fire buckets. These will be of use when the pressure service is for any reason shut off. The proper allowance is 12 buckets for each 5,000 square feet of floor space. The buckets should be distributed over the room about three in a place, and should have a placard near them calling attention to the number of buckets to be found there. The buckets should be painted red with the word "fire" in large letters, so that in case a bucket is missed from its allotted place it will be no hard matter to find the bucket and the culprit. Shop discipline should be such as to effectually prevent any tampering with these buckets.

Where possible I prefer 50-foot lengths of 1¼-inch hand hose located in different parts of each room, this hose being on swinging or automatic reels ready for instant service, and in sufficient quantity to effectively cover every part of the building. A ½-inch nozzle is the maximum size allowed by the inspectors to be attached to a sprinkler service, and this size is quite large enough for any service to which hand hose is liable to be put.

Chemical extinguishers may be used in rooms where water from hand hose would be ruinous to valuable stock. In the paint shop of a manufacturing establishment I once saw a large box of sand placed on wall brackets in a conspicuous part of the room bearing the sign, "In case of fire use sand instead of water." A large scoop sticking in the sand indicated how the sand should be used.

If the plant has a fire pump, it should be of the underwriter pattern, of ample size, and should be connected with a boiler large enough to furnish the steam under normal condition. A 1,000-gallon underwriter pump will require a boiler horsepower of 150, builders' rating. Many people do not realize the quantity of steam used by these pumps. The water mains in the yard should be not less than 6 inches diameter, and, if possible, should be laid without any "dead ends," so that a hydrant will be fed in two directions, thus getting plenty of water for two full streams from each hydrant. There should be a first and a second pump engineer whose duty upon an alarm of fire must be

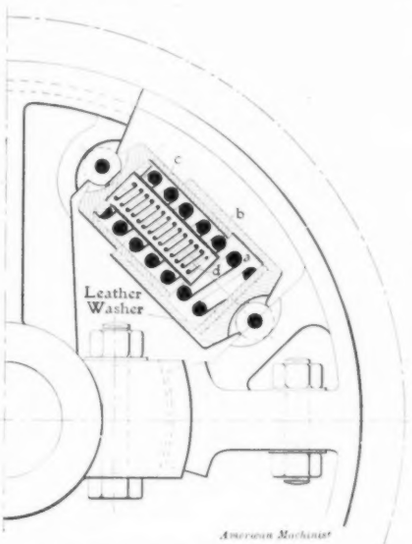


FIG. 1. ELASTIC GEAR WITH PRESSURE SPRING.

to go on watch in the pump room and keep the pressure up until relieved.

Where there is a sprinkler system and a fire pump a good arrangement of piping is to have an independent pipe of ample size run from the pump room to the water tank, with a valve in the pump room. This will enable the engineer to control the water in the tank at any time, thus enabling him to keep a heavy pressure on the hydrants without placing any dependence on float valves or other devices in the tank. In case of a disastrous fire and of the tank supports giving way, the water can be shut off at the pump room, preventing waste from the broken pipes.

City water mains should be provided with similar shut-offs, so that large broken pipes may be promptly put out of service, preventing any serious reduction in pressure. By a little judicious arrangement these pipes could all be led from a central gate-house which could also control the gas mains and city electric wires, should there be such.

After the factory is equipped with sufficient apparatus some means should be provided for regularly inspecting the same and seeing that nothing is out of place. The inspection of certain apparatus should be weekly; of other apparatus, monthly or semi-annually. The inspector should vouch for the buckets, whether properly filled, or if any are missing or leaky, mentioning in his written report each station and the condition of the apparatus there. The tools and appliances should be counted and reported in detail, the sprinkler system tested for water, hydrants flushed, pumps started, and in fact everything about the plant reported in some condition or other on a blank printed for the purpose.

The watchword of the whole department must be "eternal vigilance," for the time the firemen are not there will be the time when they are wanted. To be of any service, the department must be completely organized, well equipped, and on the alert. The fact that many such departments are the very reverse of this has caused factory inspectors to regard them with disdain and to put their trust in automatic devices.

Elastic Gears.

We illustrate herewith the pressure-equalizing gear system of J. D. Weitzer, of Gratz, Austria, these views being reproduced from the *Zeitschrift des Vereines Deutscher Ingenieure*. It supplies a yielding medium between the hub and rim which partially relieves the teeth of the shocks liable on the trolley car trucks, punches, shears, shaping machines, etc. Moreover, these gears tend to distribute the effort required in starting a motor.

There are several variations in their design. Fig. 1 indicates one of these. The rim of the wheel is of cast steel, separate from the hub which is of gray iron. On the hub are cast two complete arms grooved to meet corresponding parts reaching from the rim. Thus the rim is allowed circumferential play relatively to the hub. Between the complete arms and the rim four strong compression springs are arranged in telescoping cylinders. It is obvious that only two of them are in use at once. Smaller interior springs are provided to take up their play when relaxed. In a simpler form of gear the large springs act in tension rather than compression, and the casing and inside springs are dispensed with. The elastic system is applicable to bevel as well as to spur gears.

Another type of elastic gear, designed for machines intended for transmitting very great forces is shown in Fig. 2. Here the

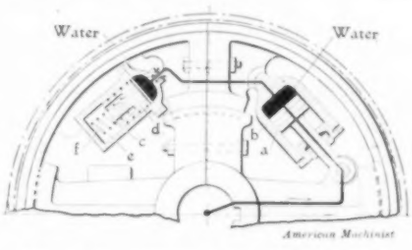


FIG. 2. ELASTIC GEAR FOR GREAT FORCES.

springs are replaced by cylinders hydraulically connected with other cylinders which have an air and spring cushion behind the piston. The water is introduced by a conduit leading through the shaft of the gear and provided with a valve which prevents its return. Certain provision as to the relief of shocks may be made by a valve arrangement in the water conduit between cylinders *b* and *c*.

Letters From Practical Men.

A Novel Blueprinting Frame.

Editor American Machinist:

The accompanying illustrations show a blueprinting frame, in use by the Cincinnati Planer Company, which is a big improvement over the old-style runway, which is usually built out of the window on to a roof, or extended out on brackets, and takes up a great deal of space inside of the room when not in use. The frame shown in the photograph can hardly be called entirely new, as it is merely a combination and improvement over the many similar frames in use in Cincinnati shops.

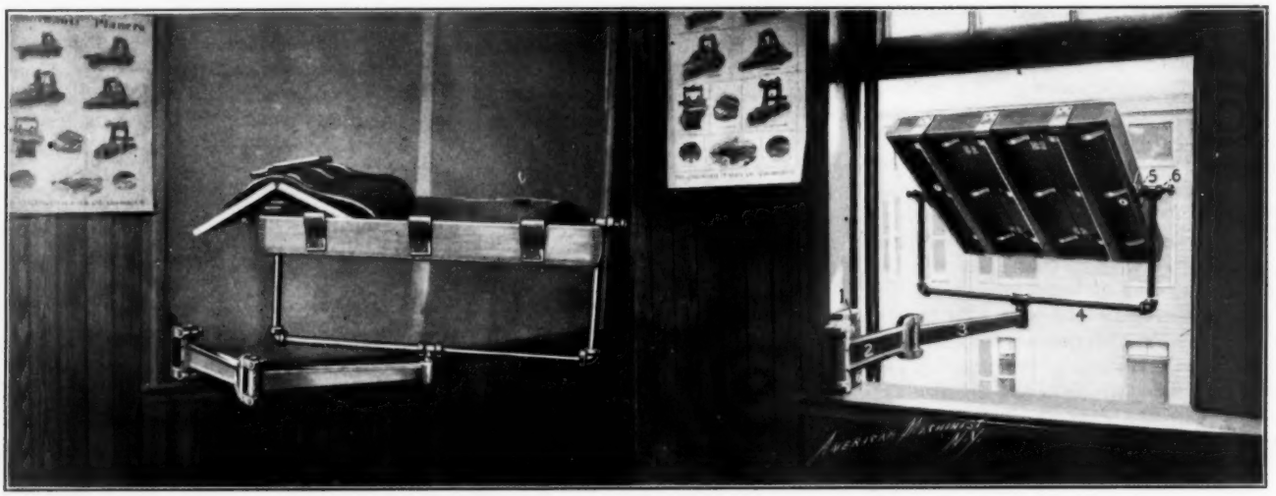


FIG. 1. BLUEPRINT FRAME IN USE. FIG. 2.

FIG. 3. BLUEPRINT FRAME OUT OF USE.

Fig. 1 shows the frame swung out with the glass down ready to receive the tracing and blueprint paper. Fig. 2 illustrates the device swung out of the window, and shows how easily it can be put at any desired angle to suit the light. Fig. 3 shows the frame pushed up against the wall, and illustrates how little space it occupies when not in use. Fig. 2 shows the various parts required to make this frame, of which 1 is a bracket which is fastened to the side of the window frame; 2 is the first link which extends out from this bracket; 3 is the second link, which is put in to get the universal motion and a longer reach; 4 is made entirely out of pipe, to make it as light as possible; 5 are brass castings, one of which is fastened to each end of the blueprinting frame; 6 are knurled knobs which are used to tighten the frame in any position after it is set. In cold weather a board as shown in Fig. 4 is put under the window to keep out the cold. Fig. 3 also illustrates the wash trough for blueprints, a small rod being put through the top of the frame with several pieces of wire extended down, which can be seen in the half-tone. On the outer end of this rod there is a weight attached, so that when a blueprint is put in position it is only necessary to raise this weight slightly, put the paper under the wires, and the pressure of the wires will hold it against the stream of water. In the extreme left of Fig. 3 can be seen a large pipe which is our exhaust pipe, passing through the drawing room on its way to the roof. By putting a few rubber bands around the asbestos covering to hold the blueprint, it forms a rapid drying apparatus for the prints.

WM. G. ZINSMEISTER, JR.

Limestone Water Without Lime.

Editor American Machinist:

At page 623 appears an item to the effect that Hibbing, Minn., gets water from a bed of iron, the water being practically free from iron. We have the same conditions in this locality as regards lime. Below the surface about 200 feet is a stratum of limestone from 100 to 300 feet thick, and the water above this stratum runs 20 to 30 grains of sulphate and carbonate of lime and magnesia per gallon, while a well drilled through, or almost through, the limestone gives a water usually so pure that it does not form scale in the boilers. The limestone seems to have so many seams or crevices that a good well is usually secured almost anywhere in this stratum.

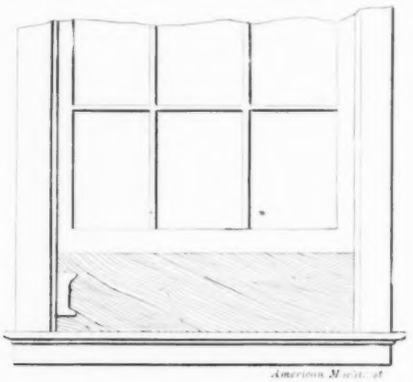


FIG. 4. PROTECTION FROM THE WEATHER.

J. O. BENEFIEL.

Anderson, Ind.

Mr. Edison and the Patent Office.

Editor American Machinist:

You have asked me to write you briefly concerning the matter of the charges preferred by Thos. A. Edison, through his attorney, against one of the principal and one of the assistant examiners of the Patent Office. I am very glad to have this opportunity of stating fairly to your readers what the circumstances really are, and possibly to disabuse the minds of some of them of erroneous ideas acquired by a perusal of the daily newspapers.

The whole matter has received a publicity wholly unwarranted by its importance, on account of two things, one of which is the universal interest attached to the name of Edison, and the other that the newspapers have made so much of the fact that the President was appealed to to direct the Commissioner of Patents to investigate the charges after the latter had dismissed them. The facts, as I understand them, are as follows:

Mr. Edison in 1901 obtained a patent, the subject matter of which involved some features of his new storage battery, of which everyone has learned more or less during the last few years. Prior to the date on which he filed the application for this patent, another party filed an application based on a somewhat similar invention. Subsequent to the date of Mr. Edison's patent—that is, after what it contained was open to the public—this party filed an application as a division of his earlier application and a patent was granted him thereon. Now, the rules of the Patent Office require that nothing shall be described or claimed in a divisional application that was not included in the original or parent case. A divisional application has the benefit of the filing date, the original date, in case a contest arises as to priority of invention. This patent, as issued, stated upon its face that it was a division of an earlier application, which, as I have stated, antedated Mr. Edison's patent.

Mr. Edison charged that the divisional case contained new matter—that is, matter not disclosed in the original case and which, moreover, was matter of which he (Edison) was the inventor, and that therefore the patent of the other party should not have been allowed to incorporate such matter, especially since it appears on its face to be a division of the earlier case, which antedates Mr. Edison's application. The commissioner dismissed the charges, stating that he had complete confidence in the integrity and ability of the examiners under him. Through a Washington attorney, President Roosevelt was asked to intervene, and he directed the commissioner to grant a hearing on the charges, on the ground that Mr. Edison has been so active and prominent before the Patent Office and the public that he was entitled to a hearing.

Mr. Edison charges that the examiners are either guilty of neglect in passing the other party's case to issue as a division of the earlier application containing the alleged new matter, or else were incompetent to pass upon such questions, and that in either case he did not want to have them act upon any more of his cases.

Nobody familiar with the practise of the Office believes for a moment that the charges as to incompetency have any weight. Even if the Acting Commissioner should hold that there is new matter in the patent, no blame other than that of error of judgment would attach to the examiners, since the identity of two inventions is a matter of opinion merely, just like the questions of invention, novelty and patentability, which are constantly being decided differently by appellate tribunals.

Any idea, such as has been hinted at by the newspapers, that the examiner was guilty of collusion with the other party in letting him have access to Mr. Edison's application papers is absurd, because, as I have stated, Mr. Edison's patent issued before the other party filed his divisional case, and therefore Mr. Edison's specification was a publication accessible to everyone.

It is perfectly safe, therefore, for your readers to believe that the whole affair is a tempest in a teapot, and that, at the worst, the Office, through its examiners, made an erroneous decision.

HOWARD A. COOMBS.

Schiele's Curve.

Editor American Machinist:

At page 518 there is an illustration of Schiele's curve, which is deservedly or not, known also as the anti-friction curve. The concern I served my apprenticeship with did a lot of work for the Britannia Pottery Company, of Glasgow, Scotland.

The potters' lathes which we made for this concern had a conical step bearing. After about a year's use these spindles would be sent back to the shop to be trued at the bearing; some of these bearings were in excellent condition, the curve being almost perfect and the surface as if burnished. As quite a number of these spindles passed through my hands, I was struck with their similarity, and filed up a little tin templet to compare them. I suggested to the foreman (a canny Scot) that as they were so much alike we could save time by making a counterbore the same shape, and then it would be necessary to make new step bushings only, and let the spindles alone. "Aye," he replied, "and hoo mony o' they spinnels wull ye ever see again?" I answered that I supposed we would have just as many as before; he then told me that that curve was the anti-friction curve, and once the end of the spindle had assumed this shape it would wear indefinitely; and while this would be all right for the pottery people it would not be so for our shop. DIXIE.

A Mexican Oil Works Experience.

Editor American Machinist:

Osborne's oil country stories remind me of an experience I once had way down in old Mexico. I had secured a position as machinist in an oil refinery in the suburbs of Mexico City. It was two or three miles out and it took nearly a whole day to find it. The "super's" first greeting was not very encouraging; it was something like this: "So you're the new machinist, are you? Well, if I'd known that was all your size I guess there would have been nothing doing. Can you speak Spanish? You said you could, but I guess it's a kind of pigeon United States Spanish." His own Spanish was vile, worse than pulque, and he told me he had been nine months in the country.

"Well, now, come along and I'll show you the plant." Along I went and saw the pumps and retorts and finally arrived at the engine.

"This will be your first job. You can see she's running badly, takes quite a lot of steam, and the governor don't seem to act just right. Do you think you can make an improvement?"

Well, I "lay low," and looked the thing over. She was a single-cylinder, overhead, imitation marine, with a slide valve. The trunk had been cracked on one side and had been repaired with a patch, but the repair had not kept the casting from opening with every stroke. There was a curious noise about the steam chest, as well as a knock about the bearings. Well, I promised an improvement and we then looked over the machine shop, which consisted of a drill press, a milling machine, a lathe and a pipe-threading machine, as well as a vise, etc.

"There are our can presses, and I might as well tell you now that you will be in charge when we run them and you must take off 20,000—I think it was that figure—a day. I can make the help do it, and so can you if you keep 'em going. I'll leave you now; just look around yourself and get the lay of the place and be ready for a start tomorrow morning."

My hours were to be 6 to 12 and 12.45 to 6. Next morning I got at that engine good and early, after having first started up a spare horizontal which they had for an emergency. I found a lever and tried for slack, which I found. I saw from a drip pipe that the stop valve was not tight and had to shut down at the boiler-house. That connecting rod was a "son of a gun." One of the bolts had been broken and a stud screwed all the way had been substituted. The caps of the main bearings had been babbitted, and with the belt on, I guess, and the oil holes had not been drilled afterwards. Now was the time for the steam-chest click. I took off the cover and found the valve had about 3-16 inch play between the nuts. The superintendent happened to pass by just then, and I had to take a back seat and turn the engine over while he set the valve to his

satisfaction and my suggestions. The valve cover was replaced and she started off and ran "like a dream."

Between times all day there was a job on the milier and pipes to thread, so when the whistle blew at 6 o'clock I gathered up my tools and vowed this would be my last day as an oil refinery mechanico.

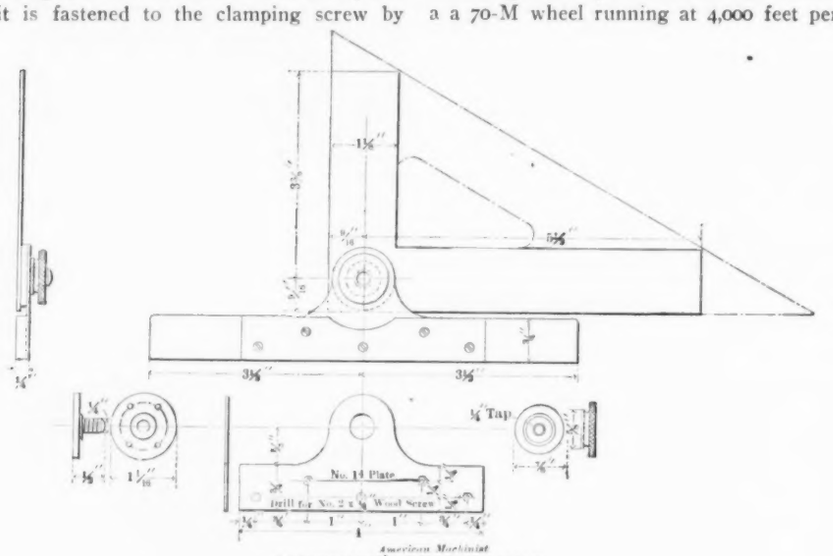
MECHANICO MEXICANO.

Draftsman's Special Angle.

Editor American Machinist:

Most draftsmen are fully aware of the trouble of making drawings on the skew; and, while this may be done by shifting the straight-edge or using one triangle against another, yet it is tiresome work and when there is much such work to do, the tool shown in the sketch is very convenient.

I made the blade of an old 30x60-inch triangle, as the dotted line will show, and it is fastened to the clamping screw by four No. 3 x ¼-inch machine screws with heads countersunk in the blade.



DRAFTSMAN'S SPECIAL ANGLE.

The remainder of the sketch explains itself.

W. HOY BRADLEY.

Grinding Small Work.

Editor American Machinist:

Of all the excellent articles on grinding I have read in your paper, I have noticed there are none on the grinding of small work, so I write this hoping it will start others in the same line.

In the grinding of small work, the hardest thing to overcome is vibration, the high speed of the work necessary to get the required surface speed increasing the chances of vibration. Many difficulties are encountered in grinding small work which are hard to overcome and to understand.

When the first modern grinder was installed in the shop and the great possibilities of the grinding machine began to dawn upon us, it was decided that our shop should be as near the front rank, in successful grinding, as possible, and a universal grinder was obtained for experimenting. The machine selected, after a careful perusal of the catalogs of different makes, was a grinder on which the emery wheel could be changed in about three minutes, and had, what we thought at the time, a wide range of speeds and feeds, having five changes of emery-wheel speeds, six changes of work speeds and five changes of feeds, every change of speed affecting the feed. For work ranging from ¼ to ⅞ inch in diameter we thought that would be plenty, but experience soon showed that it was not. We believe now that a grinder should be equipped with a variable speed device for both work and wheel having a variation so fine that a difference of one revolution a minute could be obtained within a certain range. A few facts about our work will show why this is desirable. Having several thousand pieces of ⅜-inch hard steel to grind .004 inch reduction, we tried a a 70-M wheel running at 4,000 feet per minute. We gave the work a surface speed of 25 feet per minute and a feed of ⅛ inch per revolution, a plentiful supply of soda water being used and the work being supported by back rests 2 inches apart having lead shoes ¾ inch wide. This combination worked well, but when we tried to grind the same grade of steel of ⅝ inch diameter there was no combination on that machine that would grind those pieces with the 70-M wheel. We even experimented with the water, trying clear water, and soda water and oil, but all to no effect. After grinding three pieces, the wheel would fill and refuse to cut and would have to be trued off.

In grinding work in large quantities we consider the most economical way is to use a wheel that does not have to be trued off, except in case of accident, and in rigging up for a new kind of work that is the result that we aim for.

After we had tried all the combinations of speed and feed on the machine, we saw that the only thing to do was to change wheels; so we selected the same grade, but a coarser grained wheel, a 36-M, which gave as good results as the other had on the ⅜-inch stock.

We have a job of taper grinding which so far we have not been able to grind wet. The work is ½ inch diameter by 20 inches long with a taper on one end 2 inches long. This taper has to be very accurate as regards the fit, but the straight part of this piece is not ground very accurately to size, .002 inch being the limit. If a rest is placed so that it will bear on this straight part, its variation in size will cause a like variation in the taper. So unless each piece is fitted separately the taper will not be accurate enough, and to make it so would require too much time and a more skillful operator. The way we grind them is as follows: The machine is rigged up without any rest and the taper set as exact as it can be. A 70-M wheel is used, the surface speed of the work being 32 feet per minute and the feed 1-16 inch per revolution of work, reduction .008 inch. After the machine is all rigged up, a boy can run it and get off 35 pieces per hour. We know that if we could use water that we could do a greater amount of work, but the minute we put water on, the work shows very bad chatter marks. Perhaps somebody who has had more experience than we have can help us out on this. Of course if there were some means of using a rest, there would be no difficulty.

We have another job which shows how important it is in grinding to have the work well supported. The work is 1¼ inches long, ½ inch diameter, with a ¼-inch reamed hole clear through. The material is soft steel, case-hardened, the reduction .006 inch and the limit of accuracy .002 inch, a very fine finish being required. The machine was rigged up in this way: Two short arbors were made, the operator driving a piece off and another one on, while one was grinding. Using a 70-M wheel with the surface speed of work 35 feet and a feed of ⅛ inch per revolution of work, the operator could get off about 300 pieces per day by working hard and truing the wheel every 20 minutes. At this rate a 10-inch wheel would last about three days.

That did not suit us, and we concluded that the fault was with the wheel. At this time we did not know how important it was to have the work well supported. We next tried a 36-K wheel, and that lasted a day and a half; next a 36-M wheel, which lasted a week, but did not give so good a finish. About this time we began to think there was something wrong with our method of grinding, and when somebody suggested the following idea it was instantly adopted:

A center was made to fit the headstock having a point of 15-degree angle. This center was hardened, placed in the headstock and ground in position so that the end of the center would enter the hole in the piece about 1-16 inch. After being ground to size, four flat places were

ground on it so as to give it a better grip. This center drives the work, the spring tailstock spindle having an ordinary 60-degree center holding the work against the live center. The drive is strong and stiff, and the work never slips. With this rig 600 pieces per day can be ground with less work for the operator than before. When we started to grind with this rig we put in a 70-M wheel and we wouldn't ask for anything better. In grinding 10 pieces the wheel is reduced but .001 inch. The wheel is kept set all the time, passing over the work four times on each piece and while one is grinding the operator gages the piece just ground.

PAUL WESLEY.

A Proposed Graduation for Micrometer Calipers.

Editor American Machinist:

The letter at page 689 from Mr. Moss may open up a profitable discussion in connection with the micrometer caliper.

There has been much study put upon the graduation, but so far it has proved something like the umbrella, subject to some improvements in detail, but the principle hard to assail.

Besides knowing *how* to read a micrometer, a person must be in practise to read it at a glance. It seems one trouble Mr. Moss has, is that he considers tenths and hundredths, and not straight thousandths. We have nothing to do whatever with such figures as tenths and hundredths in reading a micrometer, but with thousandths wholly.

To calculate 3 tenths + 7½ hundredths + 18 thousandths will be found more difficult than .300 + .075 + .018 (all in thousandths). The first two become .375 instantly, then the .018 is added on the thimble by 10 + 5 + 3, the 10 and 5 being plainly stamped on, while only the 3 has to be counted.

We should think that the suggestion offered by Mr. Moss would involve close line matching and also very close work, judging partially exposed spaces.

Of course, the thimble can be turned back to match the last revolution line, and then hundredths and thousandths counted on the thimble while it is advanced again to its setting, but this would be very slow.

As the graduations are at present, when there is less than a space opened by the advance of the thimble, it is known by the exact reading on the thimble; but if the thimble were numbered from one to nine in thousandths all the way round, it would be difficult to tell at a glance what the exposed spaces were without turning back and counting. J. T. SLOCOMB CO.

Providence, R. I.

The transmission line of the Washington Power Company, Spokane, Wash., is 98 miles long. It is supplied with power from two Y-connected, 2,500-kilowatt, 4,000-volt, 60-cycle generators driven by water turbines, the current being stepped up to either 45,000 or 60,000 volts.

The Chicago Joint Meeting of the Institution of Mechanical Engineers and the American Society of Mechanical Engineers.

The forty-ninth meeting of the American Society of Mechanical Engineers convened in Chicago, in the Fine Arts Building, May 31, in accordance with the program which we have previously published, the attendance including something over ninety members of the Institution of Mechanical Engineers of Great Britain.

Robert W. Hunt, of Chicago, as chairmain of the Local Executive Committee, introduced Lawrence E. McGann, City Comptroller of Chicago, who, as the representative of the mayor of the city, delivered an address of welcome, in which he referred to the rapid growth of the city and especially to limitations that had been placed upon its income by State legislation enacted about thirty-five years ago. He thought that tho this limitation might eventually prove to be to the advantage of the city, it now prevented the city from doing many things which seemed desirable to do and would account for many features of municipal work which would be differently done were the city's income less restricted. He extended a hearty welcome to the visiting engineers, not only, as he said, because the city naturally wished to extend its hospitality to strangers from distant cities and distant lands, but because he believed that the city of Chicago was better prepared to profit by the wisdom which he felt sure would be evinced in the presentation and discussion of papers than any other city in America, or perhaps in the world.

President Ambrose Swasey, on behalf of the American Society of Mechanical Engineers, thanked Mr. McGann for his hearty welcome, speaking particularly of the fact that this was the third meeting of the Society to be held in Chicago, and that Chicago was the only city in America in which three semi-annual meetings had been held. He referred to this as evidence that the members of the Society had found it pleasant and advantageous to meet together in Chicago, and believed that this was the best evidence that could be given of their appreciation of the city's hospitality.

President Swasey very gracefully welcomed the Institution of Mechanical Engineers, referring to the honor which members of the American society should feel in being permitted to participate in a joint meeting with a foreign society having such a long and honorable record, and which had included among its membership so many of the world's greatest and best engineers. He only hoped that the members of the American Society of Mechanical Engineers and the citizens of Chicago would be able to make the visiting British engineers feel as much at home as the Englishmen had made the American engineers feel upon the various occasions when the American society has held its meetings in England. Mr. Swasey very faithfully expressed what was evidently the sentiment of the membership of the American Society of Mechanical Engineers and of the Chicago hosts, his address being greeted with frequent and hearty applause.

J. Hartley Wicksteed, president of the Institution of Mechanical Engineers, replied on behalf of his society. Mr. Wicksteed's address was entirely without any attempt at oratory, but it was full of a spirit of good-fellowship and of friendliness which met with a prompt recognition from the Americans present and was also heartily endorsed by the British engineers in the audience, who punctuated the speech with frequent exclamations of "Hear! Hear!" Mr. Wicksteed said there was every reason why the visiting British engineers should feel at home here, that they generally regarded Americans as their cousins if not as occupying a closer relationship and that it was difficult for an Englishman to regard America as really a foreign country. He said they already felt at home in America and in Chicago, and he felt sure that every member of the Institution would feel well repaid for the time and money expended in visiting the country at this time. He said that at first about 300 members of the Institution had signified their intention to come, but as it later developed that the time required to make the visit would be about two months, and as most of the members of the Institution are men who are deeply immersed in business, many of them had finally found it impossible to attend; which fact had reduced the attendance to about 100.

Landing in New York, Mr. Wicksteed said he and his fellow members had seen a city of the utmost interest to them; in which commercial affairs had been developed to the greatest possible extent and in which the activities of its citizens were of the most intense character. Proceeding to Philadelphia they there saw a city much more like those of England, a statement which provoked a great deal of laughter and applause, the reason for which was evidently entirely uncomprehended by the speaker. He said that Philadelphia was very much like a large English manufacturing city. Proceeding to Washington they had there found yet another kind of city, of what might be called the classic type, with its beautiful buildings, equestrian statues, parks and avenues. Finally he said we come to Chicago, the place of all others perhaps to which an engineer should come. Here, he said, we see the evidences of the engineer's work, for tho located upon the great inland seas and with a favorable geographical position, nature had not made Chicago 12 to 14 feet above the level of the lakes; but this had been done by engineers, and by the energy of Chicago's citizens. The speaker had seen that afternoon what he referred to as one of the pluckiest and cleverest things he had ever seen, viz., the new underground tunnel, which has been constructed in Chicago for the conveyance of freight.

thus relieving the streets of a great deal of heavy traffic. The speaker seemed greatly impressed by this piece of work, and spoke of it as a very brilliant idea.

After some announcements and admonitions regarding the importance of being on time for attendance upon the various excursions about the city by Chairman Hunt, the meeting adjourned, after which there was a very pleasant informal reception in the parlors of the Auditorium Hotel.

WEDNESDAY MORNING SESSION.

The Society met at 10 o'clock on the ninth floor of the Auditorium Hotel, and President Swasey in opening the meeting announced that by a unanimous vote of the council taken the day before, Prof. John E. Sweet, whom Mr. Swasey referred to as the father of the American Society of Mechanical Engineers, had been elected to honorary membership, an announcement which evoked a hearty round of applause.

The report of the tellers of election was then submitted, which report showed that there were the very unusual number of fifty irregular votes cast, which votes under the rules had to be thrown out, this indicating the importance of a little more care on the part of the members in preparing and mailing their ballots.

THE ENGINEERING HOUSE.

Upon request of the president and in the absence of Chairman Charles Wallace Hunt, Secretary Hutton, on behalf of the Carnegie Engineering House Committee, gave a report of the work of the committee up to date, which report, tho the substance of most of it had been published, was listened to with marked attention and interest, particularly that portion which referred to the attempts that had been made to decide upon the best size for the main auditorium of the new building. Regarding this feature, Professor Hutton reported that the committee had consulted with a number of theatrical people, ministers and others who might have special information bearing upon the matter of the maximum size of auditoriums in which the best voice of the best mechanical engineer could be distinctly heard in the presentation or discussion of professional papers. The conclusion had been reached, at least tentatively, that the maximum is a hall which will seat 1,000 people upon the main floor and 500 in the gallery, having, therefore, a total seating capacity of 1,500. It was stated that the committee would be glad to receive from members or others any suggestions bearing upon this matter, based upon experience.

Regarding the library of the new building, Professor Hutton said this would occupy the top floor of the building, would be made essentially a working library in which those using it would have direct access to the books themselves, and an arrangement is now in process of formation by which it is expected that some sort of co-operation will be established between the New York City Public Library and the Engineers' Library, the one being only across the street from the other. The opinion was expressed that the proposed library will probably be *the* engineering library of the Atlantic seaboard.

Speaking of the competition which had been inaugurated among architects, Professor Hutton said that about sixty applications had been received from firms of architects who wished to compete for the prizes offered and for the greater prize of the architectural superintendence of the building, and that of these applications probably one-half would be followed by detailed drawings. It had been said by some of the architects who had gone over the matter that the specifications as drawn were the most skillful that had ever been formulated by engineers for the competition of architects.

AMENDMENT TO THE CONSTITUTION.

Under the head of new business Fred J. Miller offered an amendement to the recently adopted constitution of the Society, substituting for paragraphs C.57 and C.58 the following:

"At any semi-annual meeting of the Society any member may propose in writing an amendment to this constitution. Such proposed amendment shall then be open to discussion and to such modification as may be accepted by the proposer, and if it then receives in its favor 20 votes from among the members present it shall, at least 60 days previous to the next annual meeting, be mailed in printed form by the secretary to each member of the Society entitled to vote, accompanied by comments by the council if it so elects. The vote upon the amendment shall be by sealed letter ballot closing at 10 A. M. on the first day of the succeeding annual meeting. The ballots shall then be voted, canvassed and announced as provided in the by-laws, and if a majority of the votes cast are in favor of the amendment it shall, after declaration of that fact by the presiding officer, thereupon take effect and be in force."

In presenting this amendment Mr. Miller first read the two paragraphs pertaining to amendments of the constitution as they now stand, and called attention to the fact that they provide that any member may present any kind of an amendment to the constitution, which proposed amendment need not receive the approval of any other member of the Society whatever; need not even be seconded by any member present; may be of such character as to make it almost certain that the membership will not approve of it, and yet the secretary is compelled by the provisions of this paragraph to have such amendment printed and to mail it to the entire membership to be voted upon. It must then, after having been voted upon by the membership at large be again brought up for discussion at the annual meeting, and if it then receives 20 votes in its favor it must again be sent out to the membership to be voted upon a second time, when, if the vote is in its favor, the amendment is adopted. He called attention to the fact that in case no modification of the proposed amendment took place upon its second presentation the Society was placed in the position of being compelled to send to every member identically the same thing, to be again voted upon, and he believed it was useless to compel the Society to go to the expense provided for in this paragraph of the constitution in the case of amendments which could not, in their initiatory stage, command the support of at least somewhat more than one member.

Richard H. Soule, who had been a member of the committee appointed to revise and to reformulate Constitution and By-Laws for the Society, said that this paragraph of the constitution had been perhaps more fully discussed by the committee than any other; that there had been a larger number of alternative forms proposed for it, and that this had been adopted finally as being, in the opinion of the committee, the best that could be devised. He explained that it was felt that every member of the Society should have the privilege of coming upon the floor and presenting any amendment of the constitution which he believed should be adopted, and that the utmost freedom in this respect should be secured. Also, it had been the opinion of the committee that the final discussion of the proposed amendment should take place at an annual meeting of the Society, which meetings were usually more largely attended than any others.

In reply to this, Mr. Miller said that he fully approved of the idea that every member should have the fullest possible liberty to propose an amendment of the constitution, but he still believed that it was useless to compel the Society to be put to the expense of printing and mailing such an amendment when it could not command the support of at least twenty members before being so mailed, for a general ballot. He had studied somewhat the Initiative and Referendum as practised in the Swiss Republic. It is the privilege of any citizen of that Republic to propose a law, but he must before securing a general vote upon it by the citizenship procure the approving signatures of a specified number of his fellow-citizens, it being considered to be folly to compel the expense of an election on the question of the adoption of a law which might not be approved by any other citizen, except the one proposing it. The speaker believed that no member of the Society was denied any essential right in respect to the proposal of amendments by the proposed requirement that he should at least first ascertain whether any other members of the Society, except himself, were likely to favor such proposed amendment.

Regarding the point of the final discussion upon such amendments taking place at the annual meeting, Mr. Miller said that an anomaly presented itself in this connec-

tion; that is to say, supposing that a proposed amendment had, in accordance with the present constitutional provision, been mailed to the membership and had received their approval by a majority vote; it might then, upon further discussion at the annual meeting and perhaps some slight amendment, be defeated by a failure to receive the required 20 votes, so that the Society would be put in the position of having defeated by the action of a small fraction of the membership, gathered at a meeting, the expressed will of the membership at large. This he believed would not be right.

The speaker said that he had in mind other amendments to the constitution which he might at a later date propose. In presenting them, however, he did not wish to take advantage of the paragraph as it now stands, nor did he wish to leave it in the power of other members to present such amendments in the manner at present prescribed, but believed that this method of making amendments should be changed before any other amendments are proposed.

In accordance with the rules the amendment was accepted by the secretary, to be sent to the membership for ballot.

DELAY IN ISSUING PAPERS.

There being no further new business, the secretary, in explanation of the fact that he had been unable to distribute the professional papers to the membership thirty days in advance of the meeting, as prescribed by the by-laws, said that, in spite of numerous telegrams which had been sent out from the Society's headquarters urging the submission of manuscripts and drawings, it had been found impossible to secure them in time to make engravings and to print the papers for distribution. In order to facilitate their delivery, the American Bank Note Company had been overwhelmed with work and it had been necessary to call in the assistance of the second-grade engravers of New York city, and the utmost efforts had been made in every way to hasten preparation of papers. He said that there seemed to be among the membership a general misunderstanding as to the time required after receipt of manuscripts, drawings and photographs for the complete preparation of the papers, and he therefore felt that the delay which had occurred in the distribution of papers was due mainly to the members themselves who had promised to prepare such papers, and had then gone off to various parts of the country from which his telegrams were returned marked "unfound."

On request of the president, the secretary stated that the rules regarding the time to be occupied by the members in the presentation of papers would of necessity have to be strictly enforced during this meeting in order to get through with the program. The presentation of professional papers was then begun according to the usual mode of proceeding at these meetings, the first being entitled

A RATIONAL BASIS FOR WAGES.*

By Harrington Emerson.

This paper is one more of the numerous discussions of the wages problem which have appeared of late, and it must be said of it that the author's ideas are not of a very tangible character. He makes the positive statement that "the wage earner is not selling output, nor is the employer buying output, and any attempt to base wages on output is as irrational as to base the price of coal on boiler and engine efficiency." In spite of this categorical statement, however, the author appears to approve the methods of Mr. F. W. Taylor, which, if they do anything, base wages on output. The author's idea seems to be that wages should be based on three factors—first, time; second, skill; and third, co-operation, the allowances for the first item being the minimum wage for any occupation. He believes, also, that the state should, at least by example, fix the minimum rate of wages, and that it should do this by limiting its work so far as possible to dull times. Thus he says "when labor is scarce and materials high, governments, national, state and municipal, should carefully abstain from undertaking great works of creation or improvement, but when labor is plentiful and materials low in price, governments should carry out plans held in reserve for just such conditions."

The discussion of this paper was chiefly by the visitors from England, the first speaker being Mr. Bainbridge, who thought many of the statements in the paper to be quite extraordinary. He thought the entire argument an irrational one which tended to obscure the question. He was unable to agree with any of the positions taken by the author. He especially contradicted the statement made by Mr. Emerson that admission to certain clubs in England is contingent upon the employment of a thousand men. Mr. Chamberlain, also of the English society, was surprised that such a paper could come from a member of the American society; he disagreed with it in toto. President Wicksteed, of the English society, carried the author's comparison of the value of labor with that of coal further than was done in the paper, and said that the true method of valuing both was the same, viz., by analysis. Mr. Suplee thought that the best portion of the workman's efforts were of a nature which could not be bought with money, but were rather the result of enthusiastic management. In closing the discussion Mr. Emerson thought that in average cases the best efforts of workmen would bring about an increased production of from 30 to 50 per cent. He was quite familiar with the internal condition of factories, and found many features of all which were very inefficient.

The next two papers, being by members of the British Institution of Mechanical Engineers, President Swasey resigned the chair to President Wicksteed. Following the regular procedure of the English society, both papers were read in abstract by Secretary Worthington of that society, both papers being read and then discussed together. The two papers were as follows:

THE BURNING OF TOWN REFUSE.

By Geo. Watson.

The burning of town refuse in Great Britain has assumed large proportions, and while not much attention has been given to it in this country so far, it is bound to receive more consideration as time goes on, and this paper will be found of great value to American engineers when they come to take up this question.

The nature of town refuse in Great Britain and Continental Europe is contrasted, the leading difference being that the greater use of open fires in Great Britain for house heating leads to a much larger percentage of unburned coal in the refuse, a fact which of course adds greatly to its combustibility. He states, however, that except in one case he has never found any refuse which would not burn without the addition of fuel. The paper is, in a measure, historical and notes the leading advances which have been made in refuse destructors. One of these is the substitution of forced draft for natural draft, which has so increased the temperatures realized as to make it feasible to utilize the heat developed in the generation of steam for industrial use. Compared with coal the amount of steam obtainable is of course small, the author stating that on an average town refuse in Great Britain may be expected to evaporate its own weight of water from and at 212 degrees Fahr. In many cases this figure rises to 1¼ times the weight of the refuse in the winter season. A considerable number of plans and half-tone illustrations of refuse burners with the construction of which the author has been identified are given. In connection with these, the author states that altho many attempts have been made to use mechanical stokers in connection with these furnaces, such attempts have not met with much success. The comparative experience with fans and steam blast apparatus is given, which shows that steam blast is much superior to the fan. The results of experience with the type of boiler used are given, the conclusion being that the water-tube boiler seems destined to have the preference. The paper concludes with two appendices giving the results of tests with refuse destructors at West Hartlepool and at Westminster.

REFUSE DESTRUCTION BY BURNING AND THE UTILIZATION OF HEAT GENERATED.

By C. Newton Russel.

This paper, like the last one, is a record of experience in building refuse destructors in Great Britain. The remarks regarding the value of the preceding paper apply also to this one. The author agrees with the preceding paper in finding

*Copies of any of the papers may be had for a nominal sum by addressing the secretary of the society, at 12 West Thirty-first street, New York.

that English refuse can be easily burned without the addition of coal and that a considerable amount of heat energy can be utilized from its combustion. The paper gives in considerable detail a plant with which he has been associated in the metropolitan borough of Shoreditch, London, which has been in operation since 1897. When erected, these were about the largest works of their kind, and deal with the refuse resulting from a resident population of about 124,000. The average amount of refuse received per day is about 85 tons, the amount varying between 60 tons as a minimum in summer and 140 tons as a maximum in winter.

The steam raised from this plant is used partly in driving an electric generating system, public bath and wash houses forming also a portion of the means for utilizing the heat obtained. These features of the plant have been eminently successful. The residue remaining after the burning of the refuse is found to amount from 33 to 35 per cent. of the original weight, and this remaining residue must of course be disposed of at additional cost. For this purpose it has been found to be better than what was previously considered in London the best material for concrete, but, nevertheless, only a small portion of it has been utilized for this purpose. The paper concludes with a summary of practical suggestions regarding the construction of refuse destructors.

The discussion was opened by President Wicksteed, who stated that the author was not present and that his reply to the discussion would be submitted in writing and printed in the Transactions. He knew the author personally and knew that he had been very successful in a difficult field of work. He was the first to adopt the steam jet in place of a fan draft, a feature that had been examined and reported upon by Lord Kelvin. The paper had been prepared at the request of the American society and represents the best practise in England. Another member of the English society spoke about a destructor in use in Manchester, which he regarded among the best so far made. He preferred the continuous grate system to the isolated cells advocated in the paper by Mr. Rockwell. He gave the result of the test of a destructor at Woolwich, in which an evaporation of 1 9-10 pounds of water per pound of refuse had been secured. The capacity of the destructor per square foot of grate was also materially higher than the figures named in the paper. Mr. Charles Wicksteed had had extended opportunities for observing the operations of destructors and stated that in this field of work there is still much to be learned—that in fact present achievements represent a beginning only. There are serious nuisances connected with their operation because of the resulting smells and dust. In one case it was found necessary to do the more objectionable work at night, and even then it was found necessary for the residents in the vicinity to keep their windows closed. He believes in the system, but felt that it is in a very undeveloped state.

At the close of the professional session, luncheon was served by the local committee in the hotel, after which members and their friends took a train at a nearby station for the works of the Illinois Steel Company, at South Chicago, which were explored and inspected, refreshments being served there, and the return to the city being by the new steamer "Indianapolis," skirting the lake shore and affording a fine view of the city.

WEDNESDAY EVENING SESSION.

This session was opened by a continuation of the discussion of the papers on refuse destructors. Mr. Dunnell referred especially to the remarks made by Mr. Charles Wicksteed at the morning session. He had had some opportunity for observation and experience, and differed from Mr. Wicksteed regarding the statement that the destructors were a local nuisance. He felt that Mr. Wicksteed's experience had probably been with inferior destructors, and mentioned those in which it was possible to burn green refuse without offense, altho he admitted that the difficulty with dust had not been entirely overcome. An essential feature of a successful destructor is a large combustion chamber.

Following this discussion the regular program for the evening was taken up. This comprised five papers, four of which were upon the steam turbine. The five papers were read in abstract and discussed together, including the concluding paper by Mr. Kerr. The papers were as follows:

SOME THEORETICAL AND PRACTICAL CONSIDERATIONS IN STEAM TURBINE WORK.

By Francis Hodgkinson.

This paper opens with a statement of the ideal turbine element and then takes up the phenomenon of the expansion of steam through an orifice, this section giving the results of some experiments by the Westinghouse Machine Company. The various types of turbines are then considered, and the characteristic differences of the different types are pointed out. Especial attention is of course given to the Parsons type with which the author is identified, considerable space being given to the governing device of this machine. The use of the steam reheater in connection with compound turbines is also discussed. Exhaustive tests at the Westinghouse works show that the reheater has little, if any, value in this application. The influence of the turbine upon electric generator design is pointed out, this influence, as is well known, having led to a very marked reduction in the size of generators owing to the increased speeds at which they are operated, as contrasted with the speeds available when generators are directly connected to reciprocating engines.

A description is given of the very complete testing department of the Westinghouse Machine Company, in which generating sets of 5,000 kilowatts capacity may be tested before shipment. A considerable number of diagrams from tests made in this plant are given, these tests forming, in some cases, a regular series, in order to determine the effect of various degrees of pressure, of vacuum and of superheat. The paper concludes with illustrations and brief descriptions of several important turbine installations which are already in operation.

THE DE LAVAL STEAM TURBINE.

By E. S. Lea and E. Meden.

This paper gives the fundamental principle of steam turbine work and a very frank statement of some of the difficulties which have been encountered in the development of steam turbines. The authors state that the popular impression regarding the limitation of speed in these machines is erroneous; that there are no reasons, either theoretical or practical, to prevent the use of peripheral velocities as high as 2,100 feet per second, the real reasons which have limited the velocities used being economical. The high velocities used have created some interesting practical problems which are given in some detail. Among these is the design of the rotating member to prevent disastrous results in the case of its giving away from centrifugal strains. This has been accomplished by so designing the member that in case of rupture its periphery will separate from the central portion in small pieces instead of the revolving mass dividing into large fragments. Particulars are also given regarding the construction of the gears necessary for very high peripheral velocities of about 100 feet per second and of the system of lubrication used for the bearings. It has been found that while ring oilers are satisfactory for the comparatively low speed gear shafts, this system is entirely unsatisfactory for high speed bearings for which wick lubrication has been found most satisfactory.

The difficulties due to broken buckets and to erosive wear are also mentioned. Reference is made to the fields of usefulness to which the turbine is adapted, these being especially the driving of electrical generators, centrifugal pumps and blowers. A number of diagrams of steam consumption under different conditions are given, including the results of some very exhaustive tests by Professors Kent and Denton.

THE STEAM TURBINE IN MODERN ENGINEERING.

By W. L. Emmet.

The present paper deals with the Curtis turbine, with the development of which the author has been identified. It naturally gives in a good deal of detail the step bearing used in connection with that turbine, which, as our readers are aware, is of the vertical type, and of experience with it, which has been of the most satisfactory

character. Other details of importance are given, and the paper concludes with the results of some tests.

Different Applications of Steam Turbines.

By A. Rateau.

Like the other papers on the steam turbine presented at this meeting, the author begins by pointing out the leading characteristics of different types of turbines, and then goes on to devote most of his space to the machine with which his own name is identified. He gives the results of experience from a total of about 25,000 horse-power of turbines which have been built from his plans, and points out that this type of motor is better adapted to the driving of alternators than direct-current electric generators. He discusses the use of turbines for driving steamships and gives an account of what has thus far been done in that field. He claims remarkable results from turbine-driven centrifugal pumps and instances their use as boiler feed pumps. The applicability of turbines for driving fans is also pointed out. A field for the application of turbines for the utilization of exhaust steam from non-condensing intermittently operated reciprocating engines is discussed at some length. For this purpose a steam accumulator consisting of a vessel containing solid and liquid materials is used, which he calls a flywheel for heat. This system, if successful, would make it feasible for the utilization of considerable power which now goes to waste.

The Potential Efficiency of Prime Movers.

By C. V. Kerr.

The prime movers considered in this paper are water-wheels (with the performance of one centrifugal pump introduced for comparison), reciprocating steam engines of various types and steam turbines of five different makers. The efficiency of a water-wheel depends upon the proportion of the potential energy that is available and which is converted into mechanical energy. "Steam expanding adiabatically works at the expense of its own heat energy. From the initial condition as to pressure, moisture or superheat, expansion to the pressure of the exhaust renders available for conversion into work an amount of heat which is constant for each set of conditions. This amount fixes the limit to the economy of the engine." The data employed are gathered from various sources, and these are discussed and tabulated. The potential efficiencies of water-wheels range from 68.3 to 91 per cent., the latter being that of the "Cascade" impulse wheel. The highest potential efficiency of a steam engine is 80.5 per cent., being that of a Polish double-acting, twin, tandem compound, this being crowded closely by a Snow vertical, triple-expansion pumping engine, 80.2 per cent. These potential efficiencies vary widely from the practical efficiencies as measured by the steam consumption. Thus in the table one engine consuming 20 pounds of steam per indicated horse-power hour has a potential efficiency of 73.5 per cent. and another with 8.97 pounds of steam per indicated horse-power hour shows 72.3 per cent. The highest potential efficiency found for a steam turbine is 71.8 per cent., the steam consumption being 9.5 pounds.

The discussion of these papers occupied the entire evening and extended the session to a late hour, but general disappointment at the results of the discussion was felt. Mr. Meden criticised Mr. Hodgkinson's paper especially for its selection of the Pelton wheel as an ideal turbine element. He also referred to the question of speed, saying that while there is a limit to the strength of materials there is no limit to the strength of structures, and criticised some of the results of experiments given in Mr. Hodgkinson's paper. Mr. Waldron questioned the advisability of maintaining such a high vacuum as is commonly advocated in connection with turbines, and felt that the cost of a high vacuum is not repaid by the results obtained. He regarded 28 inches as about the economical limit. Professor Reeve discussed Mr. Kerr's paper in a complimentary manner. Commercially speaking, thermodynamic efficiency means but little. The proper basis of comparison of a motor is that between what it does and what it might do. He, however, objected to the term potential efficiency used by Mr. Kerr, for which he preferred the term cylinder efficiency. Prof. Storm Bull was very much interested in the papers, and thought it much to be desired that the tests given should be substantiated by disinterested observers. He objected to the use of the word impact, which he had always been taught should be avoided in turbine designs. The proper word to use was impulse. The phenomena of a jet of steam flowing through a nozzle are extremely obscure. Mr. Rockwood owned that he had gone over to the steam turbine. He considered the performance of the piston engine superior as regards steam economy, but that from a broader standpoint of the return from all expenditure the turbine occupied the first place. He approved the injector condenser as applied to turbines and considered it superior to the surface condenser. Professor Jacobus referred to the fact that the results of the tests given in the various papers were substantially in accordance. He thought the proper thing to do was to keep on measuring and testing rather than relying upon theory. Some points raised in the papers in connection with the test are, he said, discussed in a better manner in the report of the Society's Committee on Engine Trials, in which report simpler methods than those in the papers are shown. Mr. Suplee considered it too early to formulate a theory of steam jets. Mr. Colles raised the question of the ultimate disposition of the work of friction of the steam. He could see no place for it to go except with the steam, where it should accomplish useful work. Another member considered that the turbine is suffering from its friends, and that too much theory is being indulged in in connection with it. The theory of a high vacuum in connection with the turbine is a correct theory, but there is not much money in connection with it. He considered that the matter of high vacuum had been much overdone and that the elaborate air pump apparatus provided were often nothing but a screen to bad management. He believed in the siphon condenser for this service, with provision for doing away with the entrained air, which is the great enemy of good vacuum; for this purpose the open feed water heater is very successful. He expected to see the turbine become a standard machine for electrical and other work where its high speed was admissible.

Thursday Morning's Session.

The Power Plant of the Tall Office Building.

Under this title there were two papers presented, one by James Hollis Wells and the other by Reginald Pelham Bolton, both actively engaged in design and construction work upon buildings of this special type. These papers were so nearly alike—tho in no particular identical—that they can best be spoken of together. New York is legitimately the home of the tall office building, and the city is fortunate in that with its restricted downtown business area it has an almost ideal foundation for the buildings which it is practically compelled to erect, the footings being carried to the solid rock. It is suggested at once that the limit of profitable hight for these buildings has probably already been reached, the determining conditions being found in the buildings themselves regardless of their surroundings. The elevator problem is given prominence in both papers, and, curiously enough, while the tall building owes its existence to the modern elevator, that also sets the limit upward beyond which it will not pay to go. The hydraulic elevator is considered decidedly the most satisfactory, altho electric elevators possess advantages of their own, while the screw machines are no longer advocated and their installation is being discontinued. The elevator is the one continuous service which must be maintained through all the hours in which the building is in use and the exhaust from the engines which drive them is therefore most depended upon for the heating of the buildings, and this leads naturally to an account of the heating systems employed. This includes also the subject of ventilation and also the latest refinement of cooling as well as heating. The choice and arrangement of boilers is considered with the storage and handling of fuel, the disposition of the products of combustion, piping, feed water, etc. All buildings must pump and store their water, which is an-

other distinct problem for the engineer; then the electric service requires for itself alone the best knowledge and skill of a special class of engineers. The difficulties of arranging the complicated systems of piping and wiring so that they shall take the least space, not interfere with each other and still be accessible for examination and repair are spoken of. Numerous other engineering problems are suggested which it is not necessary to speak of here. The papers, not exceeding the usual limits of the society paper and being liberally supplied with half-tones, still convey a great amount of practical information and lead us to a higher appreciation of the engineers of these wonderful structures of the moderns.

The two papers were presented and discussed together, the first discussion being by George W. Colles, who criticised the papers on the ground that they referred simply to tall office buildings in New York, rather than to the problems connected with tall office buildings generally, or in other cities. He believed that the limitations applying to such buildings in New York city do not necessarily apply elsewhere, such, for instance, as the limitations of hight, and thought that some of these limitations applied even in New York only to certain districts, and to the present time with a prospect that changes might occur as regards the boundaries of these districts and to the other limitations. Buildings have been erected in New York that were higher than anywhere else, but he thought some of these had been built with a view to advertising effect, or with the idea of having something higher than anything else, which distinction of course tends to disappear as other high buildings are erected. The speaker thought that a little too much credit had been given to the electrical engineer in connection with the work on such buildings, and said that the electrical work done in tall office buildings was comparatively simple and easy. Certain features of such work, in fact all except the details, having been correctly decided upon early in the history of such work. He said the Edison two-wire system was the first successful system used; that it is still used and seems likely to continue to be used.

George I. Rockwood mentioned the fact that the papers refer to only two types of elevators, namely, the standard hydraulic and the electric, whereas he believed that a type of elevator known as the "plunger" would in the near future supersede them both. It had already been installed in several high buildings in New York including the Waldorf-Astoria, and was very successful both from the service and from the economic standpoint; one of its great advantages being that it commends itself to those who are looking for safety, by the fact that the passenger has always a substantial column of steel under him. Mr. Rockwood referred also to the fact that ventilation is entirely neglected in the construction of modern office buildings; the reason for this he believed is due to the fact that it costs from two to three times as much to properly ventilate an office building as it does to heat it, and owners simply would not bear that expense until the time comes, if it ever does, when tenants will demand that business offices be really ventilated. He referred to one instance where he had installed a ventilating system which consisted essentially of an exhaust fan and heating system placed upon each floor of the building, so that these separate units could be operated independently and which thus avoided the necessity for running large air conduits through the building vertically; which were objectionable on account of space taken up by them. Finally, Mr. Rockwood referred to the VanStone pipe joint mentioned in Mr. Wells' paper, and said that it had become the standard joint and that as he himself was the inventor of it and had patented it, he thought its present commonly accepted name should be retired.

G. W. Nistle defended the electric elevator; said he believed that, particularly with improved control, it would turn out to be the best form of elevator for such service. Good results were being obtained from it, he said, here in Chicago. Mr. Nistle endorsed the idea of those who look for a formula on which to base elevator capacity for an office building. Into this formula he introduced the factors of area, speed, time to accelerate and retard the car, interval between cars, and economy. A formula which he said had worked fairly well with him in most cases was: hight of building, divided by speed of elevator in feet per minute, multiplied by a factor which he had found to be about 330, divided by the interval between cars in seconds; this giving, roughly, the number of cars required to give a satisfactory service. He allowed also about one square foot of elevator floor surface to each 500 square feet of floor space in the building, with a maximum of 40 square feet in each car and a minimum of 20 square feet.

H. H. Suplee, referring to the matter of ventilation, described the ventilating system installed in the Drexel Building in Philadelphia, saying that this had proven very efficient and entirely satisfactory. It consisted essentially of ventilating registers, placed in the walls of the room, opening into flues within the walls, which flues passed upward to a large exhaust fan, placed in the attic, which fan had horizontal blades and a vertical axis and discharged air into the upper atmosphere.

S. H. Bunnell thought it was a mistake to put in compound engines in office buildings. He believed that, owing to the variable loads and excessive back pressure at times, the simple engine would nearly always give the better economy in such service.

R. L. Gifford thought that whether the hydraulic or electric elevator would be best in a given building would depend largely upon conditions, and that where the loads were light and variable the electric elevator would be better, whereas in such service as obtains in a department store, where the loads are heavy and practically constant, the hydraulic would be the better.

William H. Bryan referred particularly to St. Louis practise, stating that in that city the two-pipe system for heating had become practically obsolete. He believed that the conditions in St. Louis were in many respects quite different from those in New York, and was interested particularly in the relation between the architect and engineer. He thought it would be of interest to members of the Society to know from the secretary what such relation would be between the engineers and the architects in the construction of the Carnegie engineering building to be erected in New York.

Mr. Wells, in closing the discussion, said the conditions in New York were most emphatically different from those in St. Louis or anywhere else, and that a man in New York paying, perhaps, $18,000 per year rent for his offices would move out if the elevator service were stopped for a single hour during a business day.

At this point President Swasey handed the meeting over to President Wicksteed of the Institution of Mechanical Engineers and the next paper was presented entitled

Middlesboro Dock Electric and Hydraulic Plant.

By Vincent L. Raven.

This paper is a contribution to the proceedings of the British Institution of Mechanical Engineers. It gives results from experience with electric, hydraulic and steam cranes used at the Middlesboro Dock. This dock had originally steam cranes. When the dock was extended hydraulic cranes were installed and at a still later date the steam cranes were abandoned for electric cranes.

The plant is described in detail and illustrations of the different systems of cranes are given. The conclusion is favorable to the electric cranes, both from the standpoint of convenience and of economy of labor and coal. Comparative tables of the cost of handling materials by the hydraulic and electric cranes are given at considerable length.

The author not being present, his paper was presented by Edgar Worthington, secretary of the Institution, who afterward read a written discussion by Mr. Etherington, who said that the paper was a valuable record of facts, but criticised it on the ground that comparisons had been made between an hydraulic equipment which was fifteen years old and an electrical equipment which was new and of the most modern type. At the time when the hydraulic equipment had been installed, little attention was paid to economy, and a number of improvements in such machinery had been made during recent years.

He believed that in the future the best equipped dock might have both hydraulic and electric equipment for various services, while under certain circumstances an equipment exclusively hydraulic would be best; under others exclusively electric.

John Barr, of Kilmarnock, Scotland, expressed the opinion that while the paper was excellent and instructive in many ways, it was incomplete and he would be glad of information on several points, including the facts as to whether the hydraulic cranes were equipped with a device for raising the empty hooks by the expenditure of small power instead of, as in the old way, using the full cylinder of water at full power. He thought also that information should be given as to comparative first cost of the installation and comparative cost for maintenance, expressing the belief that consideration of these points might appreciably affect the conclusions to be drawn. The author of the paper having stated that it had been necessary to get six men at work early in the morning to move the hydraulic cranes into position ready for work on a vessel, Mr. Barr said this was unnecessary, and that such cranes can be, and are, readily moved by a hydraulic cylinder installed for that purpose. The author having figured out 25 per cent. saving in favor of the electric cranes, based, as the speaker thought, upon inadequate data, had gone on in his hopeful way to say that this saving could have been doubled under other conditions. The speaker believed that such a conclusion was by no means warranted.

Alfred Saxon, of Manchester, said that the author of the paper and those engineers who had discussed it had been considering only the saving in power, whereas he thought they should consider mainly the saving beyond, to dock owners, ship owners and the public. In this he probably had in mind the saving effected by the greater rapidity of handling and consequent saving of time by electric machinery, tho he did not specifically say so.

The Use of Superheated Steam and Reheaters in Compound Engines of Large Size.

By Lionel S. Marks.

This paper gives an unusually complete collection of the results of a number of hitherto unpublished tests on several high-speed two-cylinder compound engines, all built by the same makers and all of the same type, the chief difference being in the size, in the cylinder proportions, and in working conditions. The object of the investigations was to determine the performance of the engines under different loads, both with and without jacketing and reheating. The results throw a great deal of light upon the influence, in large four-valve compound engines, of the use of the reheater, of moderately superheated steam, of the load, of the size of the engine and of the cylinder proportions.

The completeness of the showing is illustrated by the fact that the series comprises twenty-eight tests upon nine separate engines, varying in capacity from 750 to 2,500 rated horse-power. The results of the tests of each engine are given in compact form and without undue prolixity.

The paper ends with a statement of conclusions which the author believes are justified by the results of his investigations. Thus he concludes that the saving by jacketing increases as the cut-off becomes earlier, decreases with increase of superheat, and decreases with increase in the size of the engine. Unless the reheater does more than dry the steam, he regards a separator as preferable to it. Regarding the variation of economy with the load, he considers that where moderately superheated steam is admitted to both cylinders, the heat consumption per indicated horse-power is practically constant through a range of load varying from one-half to full load and probably extending to a considerable overload. He considers that jacketing in the high-pressure cylinder is of little value when moderately superheated steam is used, and that the reheating is probably a source of loss unless it superheats the receiver steam at least 30 degrees Fahr. Jacketing the low-pressure cylinder he considers unnecessary and therefore undesirable when the reheating is effective. He also concludes that the variation, within ordinary limits, of the ratio of stroke to diameter in large-sized engines of the same power, when using moderately superheated steam, does not have any marked effect upon the economy of the engine. The size of the engine he finds to have considerable influence, the heat consumption of the smallest engine, per indicated horse-power, being about 10 per cent. greater than that of the largest, which was about three times the size of the smallest.

George H. Barrus criticised the paper on the ground that while certain of the engine tests referred to had been made by the author, others had been made by other members of the Society. He thought that an explanation should be given as to why these other members of the Society had not themselves presented the tests made by them. The author had referred to the quality of the steam at various points of the engine stroke. Mr. Barrus thought this was unwarranted, and that while the diagram showed the quantity of steam at cut-off and other points it did not show the amount of contained moisture, or, in other words, indicate the quality of the steam. He criticised also the arrangement of the tables of data, saying that the Society's Committee on Engine Testing had established a standard arrangement for this and he believed that a member of the Society should either conform to this standard or give an explanation of why he did not. He objected also to the fact that no original diagrams were shown in the paper, but only combined diagrams which were necessarily manufactured. It happened that the speaker had seen some of the original diagrams taken from engine "A." They were very poor, and if he had taken such diagrams in an engine test, such test he would certainly have thrown out. He referred to the fact that where a vertical engine is somewhat insecure on its foundation it is apt to make the indicator unsteady and to give a very erratic diagram, the inference being that he considered this had been the trouble with the cards he had seen.

Mr. C. V. Kerr referred to the matter of reheaters, and expressed the belief that these would certainly come into use again in connection with superheated steam. He gave facts and figures to show that where using ordinary saturated steam a reheater might not be justified, yet with superheated steam it would be justified, and quoted figures from the paper to prove this; the reason being that, without superheat one could not get, within reasonable limits, enough reheater surface to be efficient, whereas with 100 degrees superheat it is readily possible to keep condensation down at least to the point of cut-off in the low-pressure cylinder.

Mr. Rockwood considered that the paper was the threshing over of old straw, that the conclusions did not justify the test, that the performances given had been beaten twelve years ago by engines having high cylinder ratios—in the neighborhood of 1 to 6. Some people, he said, still like to test engines; it had only a traditional interest for him, but when it was done he liked to see the results correctly stated. He believed also that one advantage of the reheater is that it can be made to increase the power of the engine out of proportion to the cost of the reheater.

Commercial Gas Engine Testing and Proposed Standard of Comparison.

By William E. Flint.

This paper discusses the subject of commercial gas engine testing from the special view point of their reduction to a basis for comparison. The author advocates the friction brake for the determination of the output in preference to the indicator, the value of the latter instrument, in his estimation, being largely confined to its showing of what is going on in the cylinder.

The proposed basis of comparison which the author advocates is the reduction of observations upon engines of all sizes to a basis of 100 rated brake horse-power, the observations upon engines of various sizes being plotted in the form of diagrams upon this basis by which the performance of engines of different sizes can be compared and the relative performance of various sizes and types can be determined, while those of new sizes can be predicted. Examples of the reduction of observations upon this basis are given in the form of diagrams, which, it is pointed out, lend themselves to the determination of limiting curves and figures between which the per-

formance of any engine may be expected to lie.

Professor Jacobus thought it was wrong for the author of the paper to have taken out the heat of vaporization and credited it to the heat performance of the engine. He said that a committee of the Society had, after careful consideration, decided that this should not be done and he believed that it ought not to be, and that it would be just as reasonable to credit a steam engine with the latent heat in the exhaust as to credit a gas ergine with the heat carried away in the vapor of the exhaust. Referring to brake tests, he related his experience with the rope brake, saying that he had used such a brake on a wheel as large as 12 feet diameter where the pull was as high as one ton, and had operated such a brake continuously without trouble simply by putting water upon the rope; this water he said did not affect the rope and the wheel could be effectually cooled. It was necessary, however, to so arrange that the pull on the rope due to the friction would tend to lift the weight and, arranged in this way, the action was very smooth and entirely satisfactory. He said that where water was run into the inside of the wheel rim to cool it and a scoop was used to remove the heated water, allowance should be made for the force exerted upon this scoop by the rapidly moving water. Anyone, he said, who doubted that this might be an important fraction of the power developed by the engine might change his mind if he were to hold a stick in the water contained in the rim of such a wheel while running.

Mr. R. Mathot, of Brussels, gave some facts regarding recent developments in gas engine practise in Belgium and France, saying that it was now customary to use there the suction generator for gas by means of which the gas holder and many other features formerly necessary were done away with, and a generally satisfactory performance secured. He gave the results of a test of a 60 brake horse-power engine with horizontal cylinder operating on the Otto cycle in which the consumption of coal at full power had been 0.85 pounds of anthracite per hour per brake horse-power, and at half load this engine had worked on 1.15 pounds of coal per hour per brake horse-power, the variation of speed between full and half power being only 5.2 per cent. Another engine of 220 brake horse-power capacity, double acting, had given a result of 0.7 pounds of coal per hour per brake horse-power, and this had included the coal necessary to keep the generator fired during 14 hours when the engine was not working.

Mr. Mathot is not, we understand, connected with any gas-engine business, but, as consulting engineer, has made many tests of gas engines, using a special apparatus devised by himself for the purpose.

Mr. Edward J. Chambers, of Wolverhampton, England, gave a most humorous account of his experience with various power plants. He said that he had not only had occasion to install three different power plants, but that "mind you" he had not only to install them, take his fee and walk away, but that he had to stay there and operate them and endeavor to make money out of them. First, he had had a plant which was centrally located and from which he had distributed power by shafting. He got tired of that arrangement and installed one in which there was a central boiler plant from which he carried the steam about in pipes. Those he said who had had experience with the condensation of steam in pipes and the joints in said pipes would know what that meant. He had gotten tired of that arrangement and when the third plant came to be installed he had considered electrical distribution. But while he had a very great admiration for electricity he had also a check book and the limitations imposed upon him by a contemplation of the check book had led him to abandon all thoughts of electricity and to seek something which would be less severe upon said check book; this had turned out to be the gas engine of which he announced himself the warm friend and admirer, saying that he felt only pity for those who were wasting their time discussing the relative merits of the turbine and of the reciprocating steam engine, both of which were in his opinion bound to be superseded by the gas engine. He had at first installed his gas engines of too small a size, not that this was his own fault, but that his partners had insisted that he should progress by gradual steps. A great nuisance, he said, are these cautious partners. He had an excellent test for these gas engines, that was to examine the expense account for operating them, not an engineering test, to be sure, he said, but nevertheless a very good one, and such test had shown that the expense for power had been reduced about 50 per cent.

The evening of Thursday was occupied by a reception at the Art Institute which was largely attended and enjoyed by all.

FRIDAY MORNING SESSION.

This session was held in the main theater of the Lewis Institute, the first paper being read in abstract by Secretary Worthington, the presentation being accompanied by a series of very striking lantern slides from the photographs of which halftones are given in the paper. The title of the paper was

APPENDIX IV TO SIXTH REPORT OF THE ALLOYS RESEARCH COMMITTEE.

By Dr. Wm. Kempbell.

This paper relates to investigations of structures formed on the surfaces of small ingots and buttons of aluminum, antimony, bismuth, cadmium, copper, gold, lead, platinum, silver, tin and zink. Each of these metals is treated in detail. A large number of half-tone illustrations from photographs made by the microscope of the metals under examination are given.

Upon this paper there was no discussion, and the next one to be taken up was entitled

CAST IRON, STRENGTH COMPOSITION SPECIFICATIONS.

By J. W. Keep.

This is an investigation of nineteen series of tests made for the Committee on Tests of the American Society of Mechanical Engineers in 1894 and 1895, and of twelve series made in 1899-1901 for the Committee on Tests of the American Foundrymen's Association. The strength and chemical composition of the various test bars are shown by graphical diagrams and deductions are drawn regarding the influence on the strength of the bars, of silicon, total carbon, combined carbon, graphitic carbon, phosphorus, sulfur and manganese, altho in cases of sulfur and manganese the indications are not of a positive character. Considerable attention is given to the influence of the size of the test bar, and the conclusion is drawn that the strength of any size test bar cannot be calculated by any mathematical formula from the measured strength of a bar of another size, but an original table is given for obtaining the strength of any size test bar from the measured strength of a standard test bar. The investigation leads up to a set of proposed specifications for gray iron, and following this comes a statement of existing methods and specifications in which no uniformity is found. The necessity for the specification of chemical properties is insisted upon, and attention is called to the fact that slight changes in the proportions of test bars have a greater influence upon strength than is commonly believed.

The discussion was opened by Mr. Thomas D. West, who differed from the author in regard to the best section of test bar. He found no difficulty with round bars which have been adopted by some associations. He objected to the square test bar as erratic because of the influence of the corners. Mr. Emerson referred to an experience of his in connection with an inquiry which he was called upon to make in connection with an improvement of the methods of a certain machine works. His first impression was that the foundry was so well managed that he could make no improvement there, but when taking up the machine shop he found so much variation in castings as regards hardness that the operation of the machine shops were greatly restricted. He thus found that his first conclusions were erroneous and that in fact the foundry required careful attention. He sought advice from Mr. Keep, and by the application of such methods as those which are outlined in the paper the difficulties were overcome and the output materially increased. He mentioned this to illustrate the very practical value of the investigations in which Mr. Keep is engaged. Mr. Chambers considered the subject of large importance, but opposed the round test bar. Mr. Keep, in closing the discussion,

referred to the use of rectangular test bars in England and to the practise of testing them on edge instead of flat. He regarded the latter position as preferable because it simplified the relation between the rectangular bar and a square bar, having a side equal to the short dimension of the section.

The next paper to be taken up was on

EXPERIMENTS WITH A LATHE-TOOL DYNAMOMETER.

By J. T. Nicholson.

This paper is one of those belonging to the British Institution of Mechanical Engineers, and embodies the results of a very important series of experiments. They are the outgrowth of trials upon high-speed tool steels made by the author for the Manchester Committee at the Manchester Institute of Technology, which were reported in our columns. In those experiments there was no obvious connection between the shapes and angles of the tools and the cutting forces deduced from the power measurements.

The object of this new set of experiments is to determine not only the forces involved in turning the work, but also in moving the slide rest both in traversing and surfacing. The paper reports the results of over 300 serial trials, each requiring the making, recording and reducing of from 50 to 100 observations, but, nevertheless, it is only looked upon as a first installment of the work to be done.

Two dynamometers were made and used in these experiments, capable of measuring forces up to 15 tons on the tool point. The first of these dynamometers was adapted for the measurement of vertical forces only, while the second measures both vertical and horizontal forces. Illustrations of the dynamometers are given, which are of the hydraulic support type well known in connection with the Emery testing machine. Extended tables and numerous diagrams of the results obtained are given which are of fundamental importance and deserve the highest praise. They represent experiments in a field in which there has been much hypothesis and speculation, but very little investigation.

The discussion was opened by President Wicksteed, who referred to the exhibit by Taylor and White of their high-speed steel at the last Paris exhibition, which exhibit he characterized as a revelation to all engineers. He regarded the introduction of this steel as inaugurating the greatest revolution that has taken place in his lifetime. He then referred to the large importance of the experiments described in the paper. Mr. Emerson referred to the manner in which Messrs. Taylor and White had been led to undertake the investigation which had led to their discovery of high-speed steel. In connection with Mr. Taylor's time study methods at the Bethlehem steel works it was observed that certain tools accomplished results far in excess of others which were made of the same steel, and on investigation this was found to be due to accidental variations in the heat treatment, and following up this clue the Taylor-White steel was the result. He considered the influence of these steels in directing attention to careful time study and analysis to be of even greater importance than their property of working under high speeds, because he considered the savings possible when proper time study methods are used to be greater than those resulting from increased cutting speeds. Mr. McGeorge said that no adequate discussion of the paper could be made without extended study of it. It gives important information regarding the strength required in the construction of machine tools. At present, while the machine-tool builder is aware that his machines need strengthening, he does not know where the extra metal should be put, and the speaker felt that it was through such investigations as this that the required knowledge would be obtained. Professor Benjamin considered this the most valuable series of experiments upon the subject that had ever been made. The completeness of the apparatus rendered all previous apparatus for this purpose antiquated, and it would be superfluous for anyone to continue experiments of this nature with old-style apparatus. Mr. Pilton referred to complaints that existing machine tools were not equal to the work imposed upon them by the new steels. In several cases investigation of these complaints had shown that the countershafts were not operated at the speeds specified by the maker. Few realized the importance of the proper speed for countershafts, and he had found it true that with the existing types of machine tools the simple speeding up of the countershaft enables very satisfactory work to be done with high-speed steel; the reason being, of course, that the driving belt is speeded up and the back gear brought into action on work which, without this change, would call for the direct belt speed only.

The concluding papers upon the general subject of locomotive testing were then read in abstract. The first of these was entitled

ROAD TESTS OF CONSOLIDATION FREIGHT LOCOMOTIVES.

This paper, by E. A. Hitchcock, Professor of Experimental Engineering at Ohio State University, reports a series of tests of locomotives in actual service on the Hocking Valley Railroad, made principally by some senior students of the university. The usual account of the apparatus employed is given, with the precautions taken for accuracy in their various readings. The records seem to have been conscientiously and thoroughly reported, there being, for instance, sixteen pages of indicator diagrams and three large folding plates, and they should be valuable for reference and comparison.

LOCOMOTIVE TESTING PLANTS.

By W. F. M. Goss.

This paper by Professor Goss is in the nature of a compilation and should be of permanent value to engineers. It tells first of the experiments of M. Borodin, engineer-in-chief of the Russian Southwestern Railways, made in the shops at Kieff. The first testing plant at Purdue University, that of 1890, is then described and the most prominent results obtained by it are mentioned. This plant, with all accumulated and unpublished data, was destroyed by fire. The building of the new plant gave opportunities for changes and improvements which were taken advantage of. This plant is described with considerable interesting detail. Of the work of this plant the writer says: "It is perhaps not too much to say that some of the facts concerning locomotive performance, which to-day are generally accepted, and hence quite commonplace, were first made known, or, if previously surmised, were confirmed by results obtained from this plant." The experiments of Robert Quayle, at South Kaukauna, Wis., are spoken of and then several other testing plants are successively described, including that of the Chicago & Northwestern, the Columbia University plant and finally that of the Pennsylvania Railroad at the St. Louis Exposition, the liberality and enterprise displayed in the latter being highly commended.

TESTING LOCOMOTIVES IN ENGLAND.

This short paper is one of those contributed by the members of the British society. It consists of two parts: the first, by Mr. G. J. Churchward, gives a brief description of a new plant which has been installed by the Great Western Railway at Swindon, and the second part, by Mr. W. F. Pettigrew, deals with the instruments and the results required at a test. The enumeration of the results required, giving fifty different particulars, conveys some idea of the information that may result to the profession from such tests if competently conducted.

Mr. Forsythe, in discussing Mr. Hitchcock's paper, drew comparison between the performance of locomotive boilers as they are disclosed in the paper and stationary engine boilers. In this comparison he found numerous discrepancies in the experiments, and he also pointed out that the locomotives under test were in bad condition. Secretary Worthington, who until recently was engaged in locomotive design, referred in a very complimentary manner to the work done by Professor Goss with the locomotive testing plant at Purdue University.

The discussion of the papers being completed, Judge Kohlsaat, president of the Lewis Institute, delivered a short address of welcome to the Institute. Following this Mr. R. W. Hunt announced the death of Mr. David R. Fraser, one of the foun-

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International Engineering Co-operation.

The joint meeting of the American and the English mechanical engineers is simply a recognition of the universal identity of interest and of the helpfulness of the widest co-operation. The engineers of the world in their engineering are not competitors but co-workers. The aim of each true engineer wherever placed must be to accomplish the most and the best, and the total of this accomplishment is most augmented by letting the best methods of each be known to all. The policy of secrecy has departed long ago from the engineering world, and it was never a profitable one. More was always lost by concealment than by frank revelation.

The great transatlantic engineering societies long ago set the example of telling what their members individually were doing and of how they were doing it, and then of unrestrainedly criticising each other, and it is a simple matter of professional history that those who have been freest and readiest to tell in minutest detail their means and methods in the society transactions have stood highest in their profession and in the estimation of the greater world; have been in fact in their day the greatest living engineers.

It is not altogether easy to reconcile this conceded frankness of revelation in British society transactions with the notorious niggardliness that has prevailed as to the revelations of the details of operation such as are to be obtained by familiarity with the insides of each other's workshops. This barring of the shops to outsiders has not been at all, as we understand it, for the purpose of keeping out the prying eyes of foreigners, but has been just as vigilantly exercised against friends and neighbors who might happen to be also competitors, and against the universal mechanical world which might peradventure learn something. It has apparently been forgotten in some shop managements that the imparting of knowledge to others does not at all impoverish him who already has it, while he who receives it has usually something to impart in return which shall be so much clear gain to the original giver. The quickening impulses to mutual and generous suggestion which accompany the free interchange of present knowledge are among the most important of our means of progress. These have had generous growth under American free and—perhaps—easy shop discipline, or, as some might say, lack of discipline, yet we must believe the engineering profession and, in the results, the nation at large have been the gainers. It is to be hoped—and we hope with the rest—that our British visitors will fully "catch on" to the American shop motto, "Visitors Always Welcome."

As to the meeting itself and the conducting of it, it is difficult to see how these could have been better. The local committee, whose chairman was R. W. Hunt and secretary John H. Warder, had prepared to do everything possible for the comfort and enjoyment of visiting members and guests, and did it; while the meetings themselves, under the guidance of Presidents Wicksteed and Swasey, were conducted in a thoroughly business-like and most excellent manner.

The new system of registration proved a complete success. Instead of a long line of members waiting their turn to register, a dozen or more could be filling out numbered cards simultaneously and, carbon paper being used, this one card was duplicated by two others. One set of cards arranged in numerical order then went to the printer, another set was filed alphabetically and another numerically, so that, by the new system, not only was much time saved, but the results in the way of available information regarding members in attendance were much superior. Mr. Hoadley informed the writer that the idea of this system was derived from some shop order system which he saw at the Saratoga meeting, and it has certainly been well thought out and applied to the needs of the Society.

Industrial Oxygen.

We learn from the *Manchester Guardian* of May 15 that a plant has been erected at the works of Messrs. Gallaway, near Manchester, England, for the commercial production of oxygen and nitrogen, especially the former, through the agency of liquefied air. The suggestion that this use of liquefied air might eventually prove to be its chief commercial use has been frequently made, but we are not aware that attempts have been made to put it into practise as a commercial enterprise before.

The principle of the process is precisely the same as the separation of alcohol and water by distillation. The two substances vaporize at different temperatures, and when liquid air is allowed to evaporate the gas escaping from it is mostly nitrogen, the remaining residue becoming more and more rich in oxygen.

It is obvious that by liquefying the air and then allowing it to evaporate the two gases may be separated more or less completely in this way. No doubt, as with the distillation of alcohol, it will be found impossible to make a complete separation in this way, tho just how perfect the separation is, we do not know.

There are already some industrial applications of oxygen which make the process a promising one. One of these is of course the common calcium light and another is in bleaching. A supply of compressed oxygen is also nowadays a regular part of the equipment of hospitals and of the stock of many drug stores. It is also thought possible that the production of oxygen may be made cheap enough to make its application feasible to some metallurgical operations. The existing plant at Manchester is capable of producing about 200 cubic meters of industrial oxygen per hour in the production of which, if we are correctly informed, pressures of

only about four atmospheres are employed. It has been found that at the excessively low temperature of liquefied air a constant emission of rays goes on which exhibit some of the properties of the X-rays in so far at any rate that they seem to penetrate solid bodies.

American Mining Congress.

The seventh annual session of the American Mining Congress will convene in the city of Portland, Oregon, August 22, and continue until the 27th. During the holding of this assembly, there will be questions acted upon of vital importance to the general public. Among them will be: "The relation of mining to the general industries of the country"; "The creation by government of an Independent Department of Mines and Mining, whose secretary shall be a member of the cabinet of the President of the United States"; "The recodification of our mining laws"; "The permanent location of national headquarters for the American Mining Congress"; "The great benefits that will be derived by the nation from making the Lewis and Clark Fair in 1905 a great success." These subjects are of national interest, and will be presented and discussed by gentlemen of national reputation. Portland is a handsome, flourishing city, a most important railroad point on the Pacific coast, and enjoys unexcelled advantages in water transportation. Contiguous to Portland are inexhaustible mineral fields, fertile valleys with wonderful timber and agricultural lands. Its river boats reach all points of importance on the magnificent waters of the scenic Columbia river and its tributaries; and its ocean-going passenger and freight steamers run directly to San Francisco, Yokohama and Hong Kong, touching at all intermediate places of interest, and are unsurpassed for strength, beauty and comfort. In no part of the United States can there be found a more superbly delightful summer climate than in the city where this coming session of the American Mining Congress will assemble in August. The atmosphere is clear, cool, invigorating, and such a thing as oppressive summer heat is unknown. The city is clean and healthful and supplied with the clearest and very best cold water from mountain streams. The scenery in and around Portland is, it is claimed, unequaled by any other on the continent. At its very gates rest the five imposing mountain peaks of Tacoma, St. Helens, Adams, Hood and Jefferson, covered with perpetual snow.

A Japanese Engineering Society.

There has been recently formed in Japan a society which will be known as the Oriental Engineering Society of Japan, with an office at 15 Tsukiji Itchome, Tokyo. The society consists of four members, three Japanese and one American. Mr. Chas. A. Francis, the American member of the society and its secretary, was for some time connected with the Pratt & Whitney Company, of Hartford, Conn., and resigned his position there last September to accept the position of instructor in the mechanical engineering department of the Higher Technological School of Tokyo. Two of the Japanese members, Prof. Nakahara and Prof. Okobo, also are connected with the same school. Prof. Nakahara is a graduate of the Imperial University of Tokyo, Japan. He has traveled a good deal through America and England. While in England he took up special work in Prof. Unwin's mechanical laboratory in London, and he also spent some time with Prof. Ripper in Sheffield, and also has traveled in Germany. Prof. Okobo is a graduate of the Michigan College of Mines, Houghton, Mich. He is a great believer in everything American. The other Japanese member of the sociey is Mr. Issa Tanimura, a graduate of Yale College, New Haven, Conn., and now a patent attorney in Tokyo. He is also engaged in the exporting and importing business.

Mr. Tanimura left Japan on April 29 for America. He will visit the World's Fair at St. Louis, and then, after attending to business in some of the principal cities, will return by way of England. He expects to reach Japan about October 1.

The object of the society is the advancement of all things pertaining to mechanical lines. The members will act as private consulting engineers, and, as such, design special tools and fixtures for more rapid output. One of the essential things they propose doing is the training of the workman in accurate mechanical work, as that —as we understand it in America—is almost an unknown quantity in Japan. They also expect to have at a later date an evening school for the workmen of the different manufacturing concerns, where they can not only see the latest designs of machine tools, but also learn how to run them, and turn out accurate work, as is done in many of the evening schools in America.

The oblique elevator, escalator or traveling stairway seems to be gradually working itself into permanent employment. In New York it is found in several of the department stores and at two or more of the stations of the elevated railroad, and it is promised for more of the stations in the near future. The practical objection seems to be not in its use but in the maintenance of the device. Each installation consists of a great number of pieces each subject to wear or other derangement and any piece that gives out stops the whole. Much encouragement is to be got from remembering the old horse-powers that used to be seen at railroad stations and elsewhere and generally in operation when there was any wood to saw. Take out the obliquity of the arrangement and we have at once the traveling sidewalk, and there is serious talk of installing that also on one of the bridges. The length of the platform of course multiplies the opportunities for derangement and stoppage, so that confidence must not be expected to anticipate the event of success but rather to follow it.

There has recently been organized the Cincinnati Society of Mechanical Engineers. The officers for the ensuing year are: T. A. Sperry, president; S. M. Ratliff, vice-president; G. W. Hart, secretary; J. C. Lemon, treasurer. The organization is founded on essentially the same lines and for the same class of work as is the American Society of Mechanical Engineers, and is, in fact, organized as a local branch of that society, and is the first to be so organized.

On June 2 nineteen apprentice machinists were graduated from the evening schools connected with the works of R. Hoe & Co., the well-known printing press manufacturers of New York. Appropriate exercises were held in the DeWitt Memorial Church, the principal address being by Judge Frederick E. Crane, of Brooklyn. He said: "It is a great thing to make a printing press, but it is a greater thing to make a man, and here we have the two processes going on at the same time."

The Chicago Joint Meeting of the Institution of Mechanical Engineers and the American Society of Mechanical Engineers.

[*Continued from page 773.*]

ders of the firm of Fraser & Chalmers, and after this the program was completed by the reading and passing of the usual resolutions to those who had been instrumental in making the meeting a success, to which was added a resolution by each of the societies concerned expressing the pleasure, gratification and profit which had been the outcome of the joint meeting. In introducing the resolution of the British Institution, President Wicksteed stated that this was doubtless the largest meeting of mechanical engineers that had ever been held, the total registered attendance being 933.

The afternoon of Friday was occupied with an excursion to the clearing yards of the Chicago Union Transfer Railway Company and to the Drainage Canal, a second excursion to the Fisk street station of the Chicago Edison Company being also organized for the benefit of those who elected the trip to the stock yards on the preceding day. The evening was occupied with a very enjoyable special concert by the Thomas Orchestra in the Auditorium Theater, which completed a meeting that will long be memorable in the annals of both the British and the American societies. F. J. M. AND F. A. H.

The Duty on Steel Wool.

Referring to the decision of the Board of General Appraisers of December 11, 1899, wherein it was held that steel shavings, steel wool and steel fiber, used as

substitutes for sandpaper in cleaning hardwood floors and polishing furniture and other articles of wood, were dutiable under paragraph 135 of the Dingley act as "steel in all forms and shapes not specially provided for," and not at 45 per cent ad valorem under paragraph 193, the Treasury Department has instructed the collector of customs at New York to prepare a new case and to assess duties of 45 per cent., leaving the importers their remedy of protest.

This action is based on the fact that the department is advised that the merchandise in question is manufactured from steel wire dutiable at 40 per cent. ad valorem, so that the decision of the board produces an anomalous condition in which a finished article advanced by a process of manufacture pays a less rate of duty than the article from which it is produced.

[Our information is that steel wool is made from sheet steel, and not from wire. —Ed. A. M.]

Louis Kaiser, United States Consul at Mazatlan, Mexico, calls attention to the fact that the freight on barbed wire from New York to Mazatlan in car lots is $15 gold per ton, while sailing vessels will carry the same freight from Germany to Mazatlan, which is on the Pacific side of the continent, for $4 per ton.

At Bingham, Utah, two surveyors were killed recently by letting their steel tape come in contact with a high voltage transmission wire.

Some New Things.

BOLT CUTTER.

The bolt cutter illustrated herewith possesses some very novel and interesting features, the chief of which are the die head and chasers; the latter being arranged to cut on the ends and to swing out and in when opening and closing.

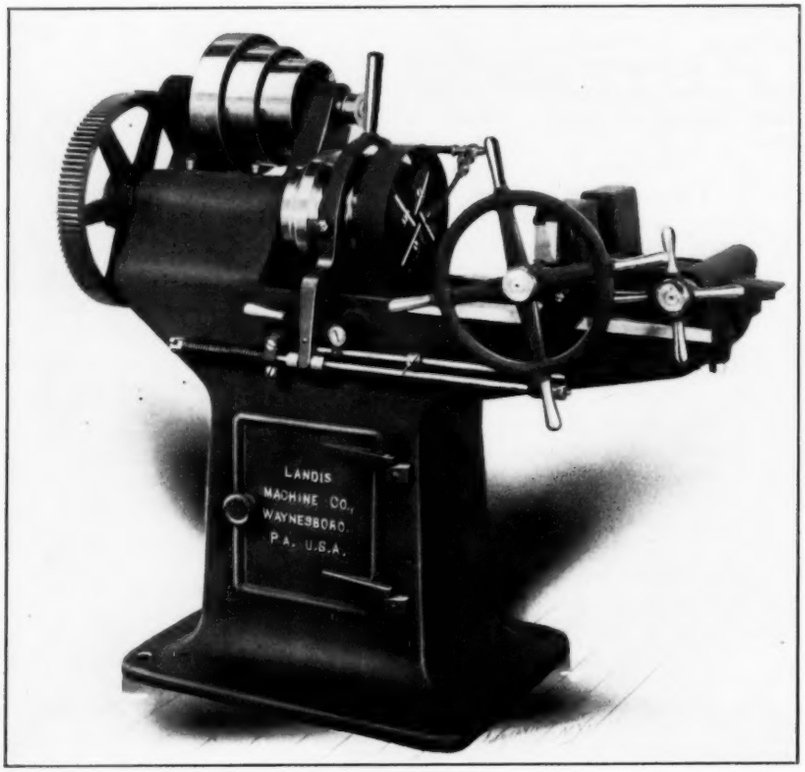


FIG. 1. BOLT CUTTER.

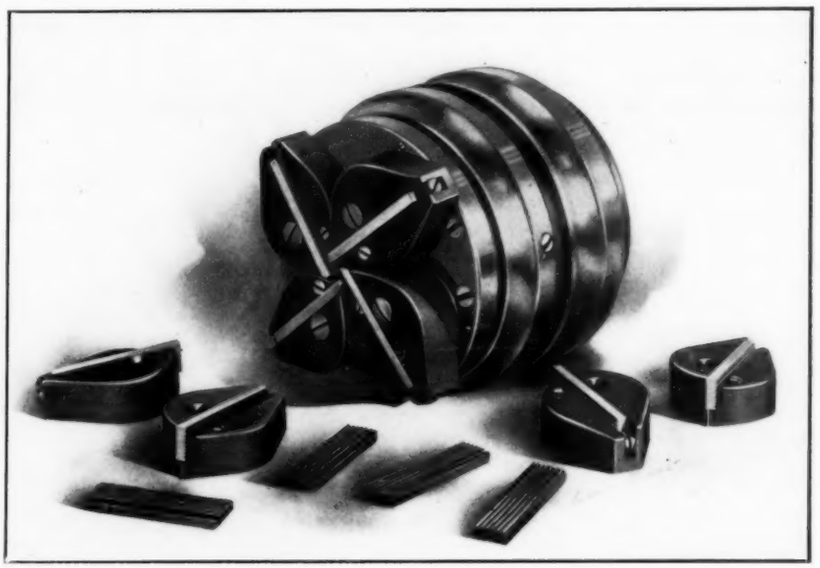


FIG. 2. DIE HEAD AND CHASERS.

As shown in Figs. 1 and 2, there are four chasers in the set and they are held, while in operation, tangential to the bolt being cut. They are made from flat pieces of steel, the teeth forming the threads being milled the entire length; and the throat of the die is formed by beveling the edges of the chasers the entire length. This gives a uniform shape so that the same results are obtained after each grinding (which is done on the ends) until the chasers are used to their limit, leaving a very small piece to be thrown away. The chasers are held in grooved blocks which are carried by four oscillating spindles geared together in the head and made to operate simultaneously to open and close the die and to adjust it to proper size. These blocks are interchangeable, being fitted nicely to hardened pins pressed in the spindle ends, and are secured by screws to the ends of these spindles. They are easily slipped on and off the pins when necessary to change the blocks. In each block is a screw, which, having a circumferentially grooved head to match the pitch of the chaser, engages the teeth on the side of the latter and draws it down to its seat in the block and also presses it tight against the side of the slot, thus holding it rigid with the block. At the other end of the block is an adjusting screw by which the chaser is backed up until worn out.

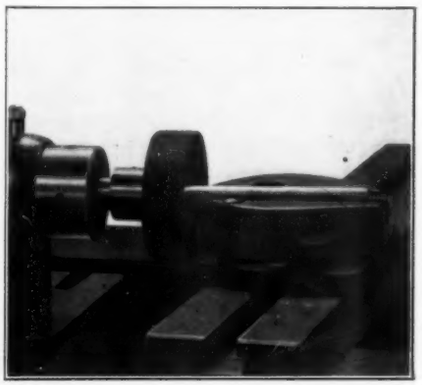


FIG. 4. CHASER GRINDING FIXTURE.

The mechanism in the head for operating the chasers will be understood from Fig. 3. The four oscillating spindles or trunnions are shown at *a* and in the face of each are the two pins upon which the chaser blocks are slipped. At *b* is a central pinion bored out to allow the work to pass through and engaging with a short series of teeth formed on each spindle *a*. Near the rear end of the pinion is fastened a disk *c* which is engaged at its periphery by a rack adjusted by screw *d* to set the die to proper size. The rack is seated in a ring *e* encircling the head; and this ring, through toggle links *f* (connected at one end to *e* and at the other to the body of the device) is given a limited oscillating movement to operate pinion *b* and so open or close the chasers. The toggle is operated by ring *g* which is moved back and forth by lever and yoke shown in Fig. 1, this ring being attached to a rack *h* meshing with a pinion *i* which also meshes with rack teeth formed on the head of toggle connection *j*. With ring *g* thrown back the toggle pin is lifted to the position shown, the links are thrown out straight as at *f*, and the chasers are positively locked in cutting position. When ring *g* is slid forward again the toggle draws the chasers open. The pins upon which the toggle links are mounted are so arranged that through openings in the rear plate the pin in ring *e* may be slid into a seat in the head proper, and the other pin drawn into a seat in the ring, thus reversing the action of the ring and giving the chaser block trunnions the right movement for left-hand chasers.

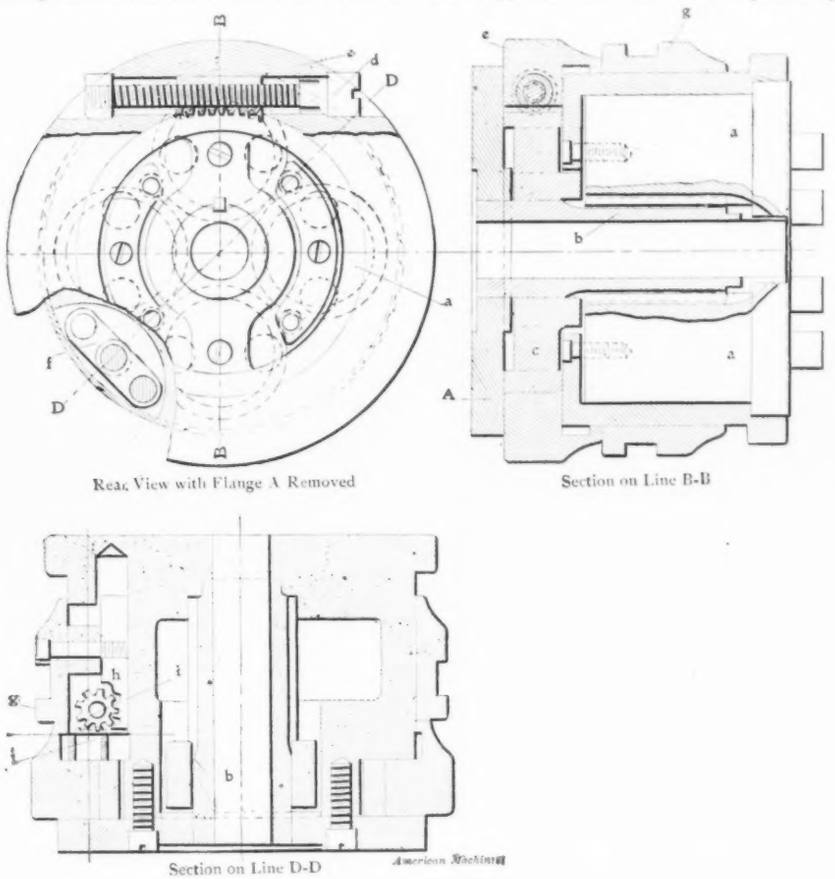


FIG. 3. DIE HEAD.

The chasers are on an angle corresponding with the pitch of the thread being cut. The cutting is at all times done by the front teeth while the back teeth do no cutting but take a bearing on the work a little back of the face of the chasers, thus forming a permanent lead nut which always remains the same no matter how often the chasers are ground, as the die is never ground in the throat. A grinding fixture is furnished for getting the correct angle for lead and rake. This fixture is used on an ordinary cutter grinder and slid along the table, as shown in Fig. 4. After the chasers are ground, a graduated gage shown in Fig. 5 is used for setting them so as to secure the proper size and assure correct position of all four parts.

While the chasers stand on angles agreeing with the thread being cut, to a limited extent a die of a certain pitch can be set to different sizes. For instance, the $\frac{5}{8}$ die with 11 threads to the inch can be set to cut 11 threads on any size from $\frac{3}{8}$ to 1 inch, with results that are practically correct. Fig. 6 shows some operations of this kind, all the different sizes on the same rod being cut with one die adjusted to the size desired through the medium of the setting gage, which brings each chaser to the correct cutting line for that particular size.

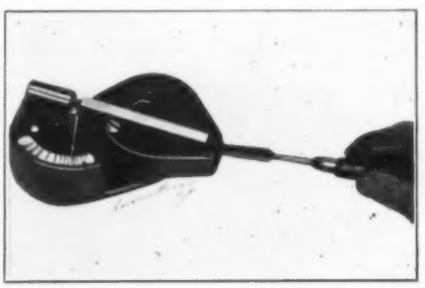


FIG. 5. CHASER-SETTING GAGE.

The accuracy of the pitch as produced by these chasers without the aid of a lead screw is indicated by the fact that a $\frac{7}{8}$-inch threaded rod 2 feet long tested with a 24-inch standard scale shows to the eye no error whatever. A rod 4 feet long when tested was within one one-hundredth of an inch of standard. The leading qualities of the die are further shown in the fact that the 5-16 die set for 5-16 bolts will reduce a piece of stock from $\frac{5}{8}$ to 5-16 inch and at the same time cut a good thread.

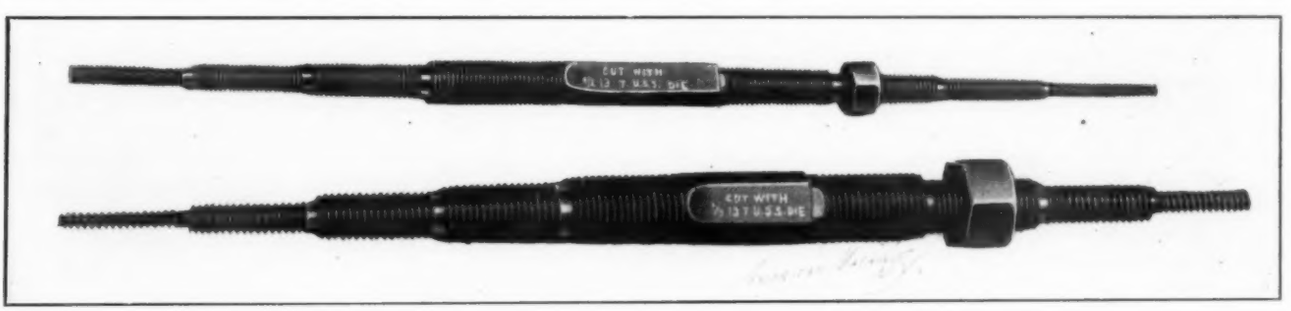
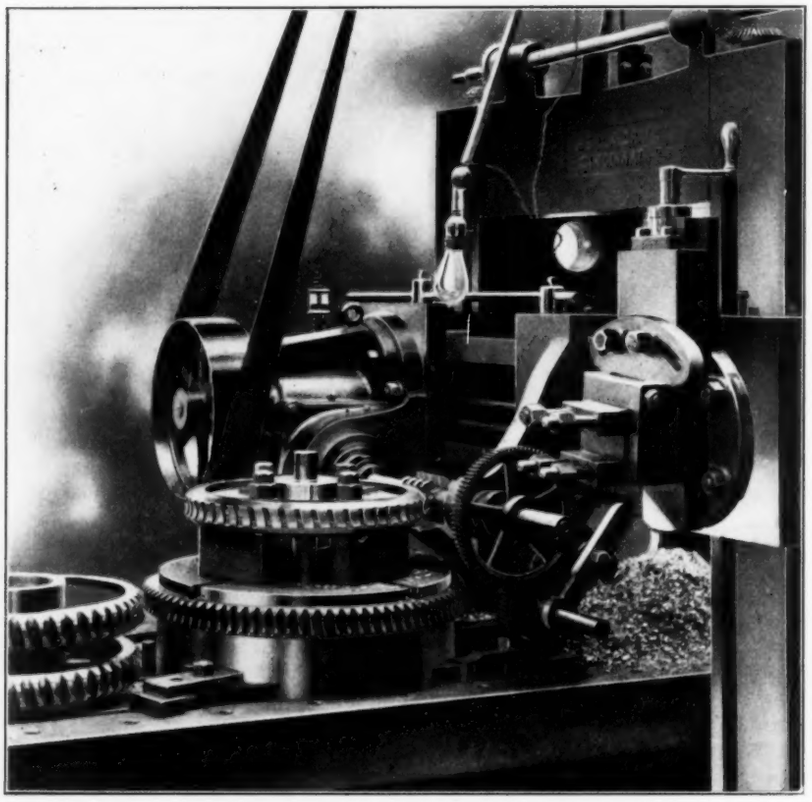


FIG. 6. SHOWING DIFFERENT SIZES CUT WITH ONE DIE.

The yoke controlling the die head on this bolt cutter may be operated by hand, or automatically, through the reach rod and mechanism shown at the front of the machine in Fig. 1. The vise on the carriage has guides centralized over the bolt being cut. The rack is immediately below the center line of the bolt. An oil pump is included in the equipment, and in the base is an oil tank, with chip pan and screen, which may be readily removed and cleaned. The machine is built in different sizes, with single, double and triple heads, by the Landis Machine Company, Waynesboro, Pa.

MILLING WORM GEARS WITH THE FARWELL MILLER.

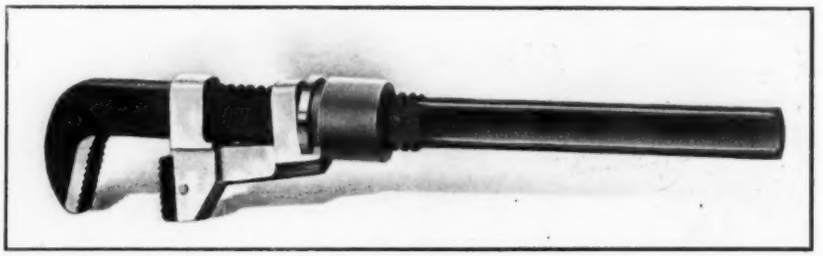
The half-tone shows very clearly an interesting special application of the Farwell milling attachment, with which our readers are already familiar. The milling device is mounted on the planer in the usual way, and then a rotating table is provided for the platen, as shown, the worm wheel to be milled being securely fastened upon the upper end of the spindle. The table is driven by a worm meshing into the lower worm wheel, this worm being driven by gears giving the correct speed ratio and connecting with the milling spindle which carries the hob. The gears are thus cut without first being slashed with a single cutter. By changing the hob and gears a great variety of worm gears may be cut. In the Adams Company's shops, Dubuque, Iowa, where the Farwell miller is made, this method of cutting worm wheels is employed on four sizes of wheels, two being cut with a single-thread and two with a double-thread hob.



MILLING WORM GEARS WITH THE FARWELL MILLER.

IMPROVED PIPE WRENCH.

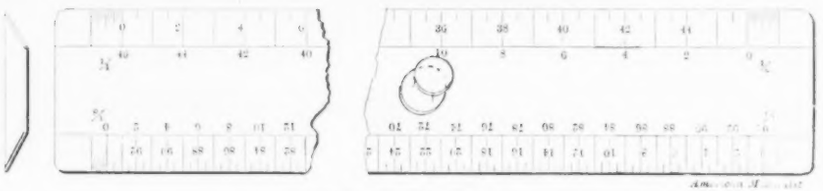
The half-tone shows an improved pipe wrench made by the Bemis & Call Hardware & Tool Company, Springfield, Mass. It is made in five sizes, from 8-inch to 24-inch, taking pipe from ⅛ inch to 2½ inches. The body of the wrench is a single forged steel bar and is made extra strong at the angle where such wrenches generally show their weakness. The gripping jaw, which has renewable teeth, is normally held away from the stem, but is forced toward it when the wrench is in use, thus securing a very tight grip. The offset of the jaws permits the wrench to be used against a wall or in close quarters.



IMPROVED PIPE WRENCH.

DRAFTSMAN'S SCALES.

In connection with the extended discussion of draftsmen's scales which has been carried on in these columns, our readers will be interested in a new pattern of scale which has been brought out by Williams, Brown & Earle, of 918 Chestnut street, Philadelphia. The instrument has but one scale to an edge, which is graduated to read in both directions, and, to avoid confusion, the figures which read from left to right are in black, while those reading from right to left are in red. The triangular form of scale is also made in the same way. The scales are of boxwood and white faced.



DRAFTSMAN'S SCALE.

E. & T. Fairbanks & Co., the well-known scale manufacturers of St. Johnsbury, Vt., have offered $485 in prizes, to be awarded next December, for the most valuable suggestions submitted by any of their employees in regard to doing the work better, easier or cheaper, or where there can be any saving in material. The prizes are divided as follows: One of $50, two of $35, three of $25, six of $15 and ten of $10. The suggestions are to be submitted in writing and will be carefully examined weekly by a selected committee.

Catalogs Wanted.

Clarence Rice Slocum, United States Consul at Warsaw, Russia, writes in *Consular Reports* as follows: I am frequently asked for catalogs of labor-saving devices so much in use in the United States, and I would thank manufacturers if they would supply this demand, even if the catalogs are in the English language.

On June 1, at Hokendauqua, Pa., the Thomas Iron Company celebrated by a dinner the completion of the fiftieth year of its continuous operation.

Technical Publications.

"National Iron and Steel, Coal and Coke Blue Book." Second edition. By B. H. Morwood. 890 6x9-inch pages. R. L. Polk & Co., Pittsburg, Pa. Price, $7.50.

This book is essentially a trade index of the iron, coal and coke industries. Its various sections give lists of iron and steel manufactures, grouped as to character of works and also arranged alphabetically, with brief descriptions of the plants and statements of their capacity, of contractors, officers, managers, etc., arranged alphabetically; of blast furnaces, iron and steel works, arranged by States; of anthracite and bituminous coal producers, arranged alphabetically; and of coal and coke producers arranged by States and districts.

"Ready Reference Tables." Vol. 1. Conversion Factors of Every Unit or Measure in Use. By Carl Hering. 196 4x7-inch pages. John Wiley & Sons, New York. Price, $2.50.

It seems scarcely possible, and perhaps not desirable, for this work to carry out the program indicated by its title of covering all the units of measure in use, but that does not affect the fact that the author of this volume has performed a most important service in arranging a series of conversion tables between various units of weight and measure which are more complete and voluminous than have been published heretofore, to our knowledge. The tables are based upon the accurate legal standard values of the United States which have been obtained from the National Bureau of Standards at Washington. Engineers who have to deal with weights and measures of various countries will find these tables of the highest degree of utility. They are equally noteworthy for their completeness and for the manner in which they are arranged for convenient reference.

"Twentieth Century Locomotives." By Angus Sinclair Company. 670 6x9-inch pages, with numerous illustrations. Railway and Locomotive Engineering, New York. Price, $3.00.

This volume is made up largely from abstracts from the pages of our contemporary, *Railway and Locomotive Engineering*, and thus represents the cream of many articles contributed to that paper. It contains chapters on repairs of locomotives and boilers, and on locomotive construction which give methods which have been found advantageous by many contributors to *Railway and Locomotive Engineering*. The operation of locomotives on the road, compound locomotives, valve motions, injectors, and other appropriate subjects are incorporated in the book. One section gives a large number of illustrations characteristic of railway repair shop machine tools, and another gives illustrations with leading details of a large number of recent notable locomotives. The book contains a large amount of information of which, in fact, its source is the guarantee. Railroad men are well known to be assiduous students of everything pertaining to their calling, and they will no doubt give this book the appreciation which it deserves.

"The Thomas Discount Book." By Millward T. Thomas. 81 5x8-inch pages. Millward T. Thomas, Williamsport, Pa. Price, in cloth, $1.00; in leather, $1.25.

The absurd custom of naming prices by compound discounts shows no signs of discontinuance, and so long as it continues it will be a source of annoyance and labor to accountants in all lines of commerce. This book of tables gives the net value for all ordinary combinations of discounts. Each set of pages relates to the leading discount from 2½ to 90 per cent., and under each leading discount all ordinary combinations of secondary discounts, up to a total of four in many cases, are given. The tables are arranged for quick reference by means of a marginal thumb index, and their utility is obvious at a glance. The book deserves and will no doubt receive a large patronage among bookkeepers.

Personal.

Paul M. Mowrey, lately adviser on industrial investments with the Merchants' Trust Company, has become vice-president of the Engineering Company of America, 74 Broadway, New York.

Lucien I. Yeomans has resigned as superintendent of the gas engine department of the Fuller & Johnson Company, of Madison, Wis., and is now with the Link-Belt Machinery Company, Chicago.

G. V. Mitchell, who has been superintendent of the gas-engine shops of the National Meter Company, New York, is now general superintendent of the Marinette Gas Engine Company, Chicago Heights, Ill.

Obituary.

Samuel R. Callaway, president of the American Locomotive Company and a former president of the New York Central Railroad, died in New York, June 1, fifty-four years old.

Samuel H. Pine, one of the last of the men well known as builders of wooden ships, died in Brooklyn, June 3, eighty years old. He had charge of the building of ships for the Pacific Mail Line, and after the Civil War he built yachts, of which perhaps the most celebrated was the "Enchantress" for Louis Lorillard.

James A. Myers, president and treasurer of the Robbins & Myers Company, Springfield, Ohio, died in that city May 27, fifty-three years old. The company of which Mr. Myers was the head was formed in 1889, he becoming president in 1900 on the retirement of Mr. Robbins. The company entered the electrical manufacturing field in 1896.

George F. Phillips, who was the engineer of the collier "Merrimack" when she was sunk at the entrance to Santiago harbor by Lieutenant Hobson, died at Cambridgeport, Mass., June 5, thirty-eight years old. A portrait of Phillips with a graphic account of the exploit in which he figured was published in our columns soon after the occurrence in 1898. He was born in St. John, N. B., enlisted in the Navy as a machinist at the beginning of the Spanish War and volunteered for the perilous duty which made him famous with the others. He remained in the service of the government after the war, with the rank of Chief Machinist, and died of Bright's disease.

Phineas Barnes died in Pittsburg, May 29, sixty-two years old. Mr. Barnes was born in Portland, Me., and learned the machinist trade in the locomotive works there, worked at the Novelty Works, New York, during the Civil War, and graduated at the Rensselaer Polytechnic Institute in 1867. Then he was in the employ of the Trenton Steel & Iron Company, and later assisted Alexander L. Holly in rebuilding the Bessemer Steel Works at Troy. After a trip to Europe he took charge of the building of the works of the Joliet Iron & Steel Company. After this he was constructing engineer for several of the most prominent steel works in the country. He had been disabled by continuous serious illness for several years.

David Ross Fraser, one of the founders of the Fraser & Chalmers Company, died in Chicago, May 30, eighty years old. Mr. Fraser was born in Scotland and began working as a machinist in Chicago in 1848 and formed the acquaintance of Thomas Chalmers, who was working in the same shop. He went to California with the forty-niners, but soon returned in poor health. In 1852 he was foreman of the Scoville & Sons Locomotive Works in Chicago, and later held the same position with P. W. Gates & Co. This later became the Eagle Iron Works Manufacturing Company, in which both Mr. Fraser and Mr. Chalmers were stockholders and superintendents. The firm of Fraser & Chalmers was formed soon after the great fire of 1871 and grew with great rapidity. Mr. Fraser retired in 1893. In the course of his business career he invented many valuable devices.

George Richmond, consulting engineer and head of the sales department of the De La Vergne Refrigerating Machine Company, of New York, deliberately and for no known reason committed suicide on June 3. Mr. Richmond was a native of England, fifty-five years old, a man of education, an expert mathematician and an engineer of high standing. He had been connected with the De La Vergne company nearly a score of years, its years of greatest growth and activity. He had been a prominent and valued member of the American Society of Mechanical Engineers fifteen years, had been a manager of the society and at the time of his death was a member of one of its standing com-

mittees. He had contributed valuable original papers and discussions to the transactions of the society. Mr. Richmond was understood to have been developing a new refrigerating system of which he had great expectations. He was also interested in the Quartz Ice Company, of Elizabeth, N. J., which is in charge of his son, a junior member of the A. S. M. E. Mr. Richmond was undoubtedly a victim of overwork, and it matters little in the result that he was self-driven.

Business Items.

The Shelby Steel Tube Company has removed its Chicago offices to 860 The Rookery.

Owing to the large number of orders on hand the Perkins Machine Company began on May 31 to run its new plant at Warren, Mass., night and day.

The Heald Machine Company, Worcester, Mass., is very busy and is over a month behind in its orders for drill grinders, wet cutter grinders and piston ring grinders. Its export business is particularly good.

The Wilmarth & Morman Company, Grand Rapids, Mich., has since May 1 shipped over thirty-five new Yankee drill grinders to various concerns in this country, including twelve to England, three to Russia, two to Canada and one to Holland.

The J. R. Vandyck Company, 8 Dey street, New York, has secured the order for the entire equipment for the new shop of Zeb & Hahnemann, of Newark, N. J., consisting of Whitcomb planer, Bradford lathes, Fosdick radial drill, Milwaukee milling machine, Queen City shaper, speed lathes, grinders, drill presses, band saw, cold saw, trimmers and small tools.

J. J. McCabe, 14 Dey street, New York, has recently bought out the entire equipment of several large shops, thus securing an exceptionally good assortment of modern-style tools in good running order, including lathes, planers, upright drills, radial drills, shapers, boring mills, milling machines, universal grinders, boiler shop tools, screw machines, gear cutters, etc. These tools will be sold quite low on account of lack of room in the warehouse.

The co-partnership of Marvin & Casler, who have been engaged in manufacturing machinery at Canastota, N. Y., for several years past, has recently been organized into a stock company called the Marvin & Casler Company. The directors for the ensuing year are H. N. Marvin, president; H. Casler, treasurer; L. R. Cooper, secretary and manager. The factory has recently been considerably enlarged and much new machinery has been added, greatly increasing their facilities for manufacturing. They are especially fitted for the manufacture of machines in quantities with interchangeable parts.

The Barberton city water works, of Barberton, Ohio, has placed an order with the Pneumatic Engineering Company, through the Pittsburg office of the Rand Drill Company, for a complete air lift plant for its new group of twelve wells. The compressor is to be a Rand compound condensing type 10, having steam cylinders 10x18x14 and duplex air cylinders 14x14. The equipment includes a surface condenser, air receiver and the usual piping and specials to make up a pumping plant under this system. The capacity will be 3,000,000 gallons of water per day. It is expected to have the entire plant in running order by the middle of August.

Manufacturers.

William Collins, Newfane, N. Y., is building a foundry.

The Niles (O.) Fire Brick Company is to build an addition.

A planing mill of Conklin & Son, at Greenfield, Ind., has been burned.

Wm. H. Grundy & Co., Bristol, Pa., worsted yarns, will build an 80x100-foot addition.

The Irving Cut Glass Company, Honesdale, Pa., thinks of erecting a factory building.

A big plant of the New York City (N. Y.) Milling Company has been damaged by fire.

Saw and planing mill and dry kiln of J. R. & T. Bunn, Fairfax, Ga., have been burned.

Large saw and shingle mills of Andrew Haslam at Nanaimo, B. C., have been burned.

The Planters' Lumber Company, Greenville, Miss., will build a sawmill to employ fifty men.

The Union Metallic Cartridge Company, Bridgeport, Conn., is building a new powerhouse.

Reading, Pa., may hold a special election relative to the erection of a municipal electric plant.

The plant of the Alabama Compress & Storage Company, Montgomery, Ala., has been burned.

The Morrison Foundry Company, Newark, N. J., has received a permit for three factory structures.

Col. A. S. Winstead and others may form a company to manufacture pottery at or near Henderson, Ky.

Barney & Berry, skate manufacturers, Springfield, Mass., are building a 36x130-foot, two-story addition.

A sawmill owned by J. F. Butcher & Co., Moorestown, Mich., has been burned and will probably be rebuilt.

The Armour Packing Company has bought a lot at Jackson, Miss., and will erect a cold storage plant there.

The German Artistic Weaving Company's Pompton Silk Company mill, Pompton Lakes, N. J., has been burned.

A plant is to be built at Woonsocket, R. I., by the Alsace Worsted Company, incorporated by Aram J. Pothier *et al.*

A two-story factory, 37x129 feet, is to be built for G. & W. Kolb, manufacturers of stove linings, Philadelphia.

The Simpson Heater Company, Newark, Ohio, will, it is said, build a new concrete foundry and machine shop.

It is rumored that the International Paper Company intends to erect a foundry, 180 feet long, at Livermore Falls, Me.

S. Karpen & Bros., Chicago, are negotiating relative to the possible erection of a large furniture plant at Kankakee, Ill.

The Des Moines (Ia.) Bridge & Iron Works will erect new factory and foundry buildings, enlarging the capacity of the plant.

A factory building, 192x40 feet, has been estimated on for Sibson & Stern, lace manufacturers, of Germantown, Philadelphia.

The Atha Tool Company, Newark, N. J., is preparing to erect some additional buildings, and has asked for a permit to build a power plant.

Engine-room, car shop, blacksmith shop, etc., at Nanaimo, B. C., of the Western Fuel Company, San Francisco, Cal., have been burned.

The Le Roy (N. Y.) Plow Company is adding to its plant. A pattern shop building is going up, and a foundry structure will also be built.

Columbus, Ga., is to have another large fertilizer plant, which will be erected by a company including O. C. Bullock and John T. Fletcher.

It is proposed to remodel a mill at Pekin, Ill., formerly owned by J. W. Sarff and now by Charles & Co., who, we understand, are Kansas people.

J. C. Bothin, of San Francisco, Cal., lessee of Carmen island, in the Gulf of California, may build a large salt plant at Guaymas, Sonora, Mexico.

The American Lighting Company will erect a factory in Baltimore, Md., for the manufacture of naphtha burners for incandescent lighting.

The Weld Bobbin & Spool Company, Lawrence, Mass., will erect a three-story brick mill and offices, a two-story storehouse, engine-room, boiler and dry rooms.

The Farmer's Oil Mill (capital stock, $40,000) has been organized at Newberry, S. C., to build a plant. The company's president is Prof. W. K. Sligh; general manager, John H. Wicker.

M. C. Howard, representing the Duponts, manufacturers of explosives, has been in Pueblo, Colo., looking toward the establishment of a powder factory in that part of the country, to employ about 1,000 people.

The corner-stone has been laid, at Eleventh avenue and Thirty-ninth street, New York city, for a big abbatoir for the New York Butchers' Dressed Meat Company, of 510 West Forty-second street, a rival to the trust.

J. E. Bun, representing a shoe manufacturing company at Bay City, Mich., has presented a proposition to members of the Business Men's Association, Pueblo, Colo., which, if accepted, will result in the establishment of a shoe factory.

A mill of the Holyoke (Mass.) Water Power Company has been bought by Clifton A. Crocker, of Springfield, and R. F. McElwain, of West Springfield, and will be fitted for paper-making purposes. A company is being formed.

The Youngstown (O.) Furnace Company has been formed and is about to put on the market a hot air heater, which will at first be made by contract, but later in a plant which the company proposes to build. Leon Gschwind is president; Wm. Ramm, vice-president.

The Vitrified Wheel Company, of Westfield, Mass., manufacturer of emery and corundum wheels, reports that its business has been very brisk and that it has outgrown its present quarters, and is now erecting a new brick, fireproof factory, which will double its facilities. This is located on the main line of the New York, New Haven & Hartford Railroad, in Westfield, and is to be equipped with electric motors throughout.

The machinery and mill supply house of C. T. Patterson Company, Ltd., New Orleans, La., has established a machine tool business under a separate department. It will carry a stock of standard machines on hand, making a handsome exhibit in its warerooms, and has employed expert machine tool men, who will be in charge. It has already closed contracts with the Cincinnati Milling Machine Company, Lodge & Shipley Machine Tool Company, Cincinnati Machine Tool Company, Bickford Drill & Tool Company, Cincinnati Shaper Company and the G. A. Gray Company, and will represent the above firms exclusively in New Orleans and adjacent territory.

New Catalogs.

Dr. Th. Horn, Grosszschocher, Leipzig, Germany. Illustrated catalog of Horn tachometers and tachographs. 9½x12½, pp. 24, paper.

Estep & Dolan, Sandwich, Ill. "The Bending Book." Catalog and price list of hand-bending tools. Illustrated. 3½x6¼, pp. 12, paper.

Some Points in Connection with the Manufacture of a Turret Lathe—The Use of Compressed Air in Jigs and Fixtures.

EDITORIAL CORRESPONDENCE.

About the most interesting set of jigs and other special appliances it has ever been my good fortune to witness in operation, I saw recently at the Pratt & Whitney shops. This series of tools was designed for use in the manufacture of their new model turret lathes, and several of the number are operated or controlled pneumatically; this being the first instance, so far as my knowledge extends, of the application of compressed air to jigs and fixtures constructed for anything but very small and light work.

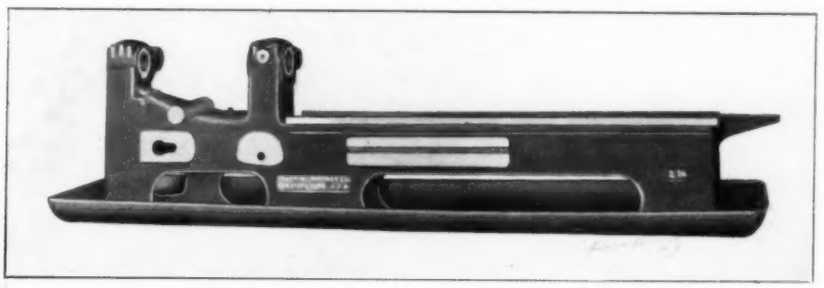


FIG. 1. PRATT & WHITNEY TURRET LATHE BED AND HEAD WITH BEARINGS READY TO BORE.

The engravings, except where otherwise noted, are from the tools and appliances used in machining parts of the 2x26 turret lathe. Similar methods are followed with the three smaller sizes, 1½x18, 1x10, ⅝x 4½, and, in large measure, on the 3x36 machine.

The first of these pneumatic affairs is a fixture for holding the turret lathe bed while the bearings for the spindle and backgear shaft are bored out. It is a heavy casting fitted with boring bar guide bushings and having a carefully finished seat to which the planed bed is held by four hook bolts operated by air pistons; the utilization of compressed air for tightening these holding down members not only facilitating greatly the operation of locating and securing the piece, but also insuring that all parts so held shall be clamped under a certain constant pressure and without the danger of deformation likely to be present where an indiscreet use is made of wrenches, cams, etc.

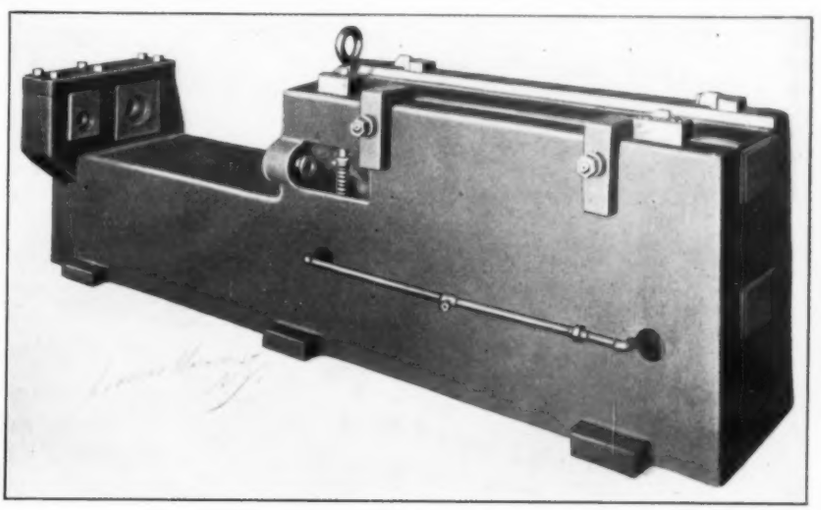


FIG. 2. BORING FIXTURE WITH PNEUMATIC CLAMPING MECHANISM.

The casting ready for the boring operation weighs upwards of 1,100 pounds, and is shown in Fig. 1; head, bed and pan being formed integrally in the mold. The ways and other surfaces requiring finishing are carefully planed, the caps fitted, the babbitt bearings for the spindle poured and compressed. The boring fixture appears as represented in Fig. 2, and is constructed in the manner shown in the line engraving Fig. 3. During the boring operation the work is of course held bottom side up on the fixture, which is clamped to the table of the boring lathe as in Fig. 4, and fed toward the head by the movement of the carriage.

It will be seen from Figs. 2 and 3 that the fixture has two machined pads or strips upon which the work rests, and a beveled surface near the back against which the front bevel of the machine bed is held, this latter beveled surface being the one from which certain other tools for the bed are located. The seat and locating surface on the fixture are very accurately formed, so that the bed will rest properly when dropped into place. The clamps *a* are set up very lightly to bring the work against the bearing surface at the rear and then air from the pipe from the receiver is admitted to cylinders *b* by turning a valve at

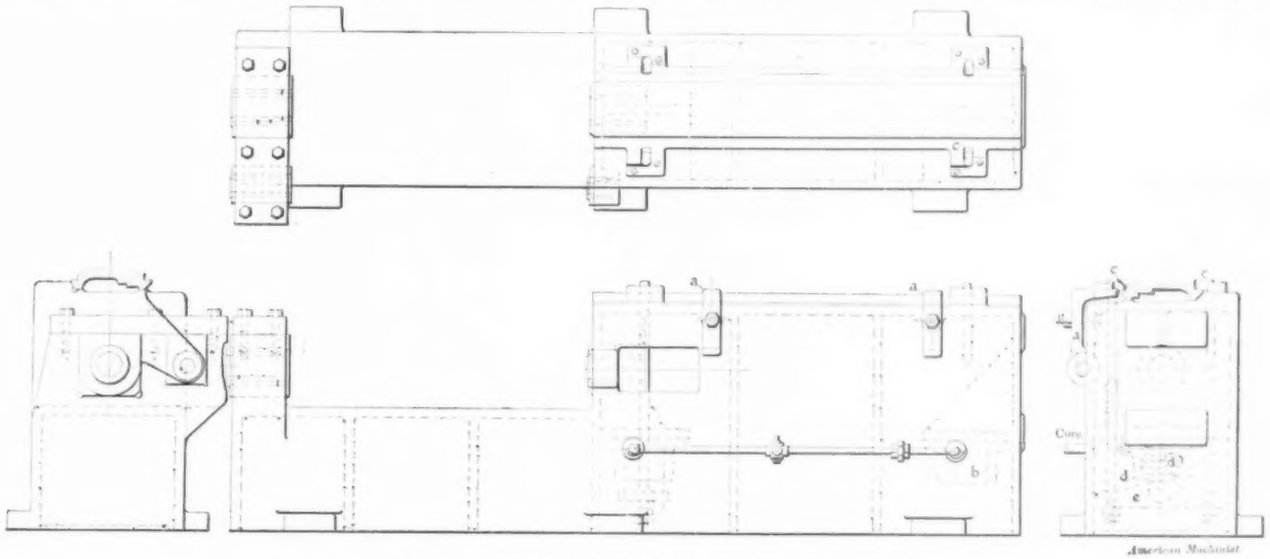


FIG. 3. SHOWING CONSTRUCTION OF BORING FIXTURE.

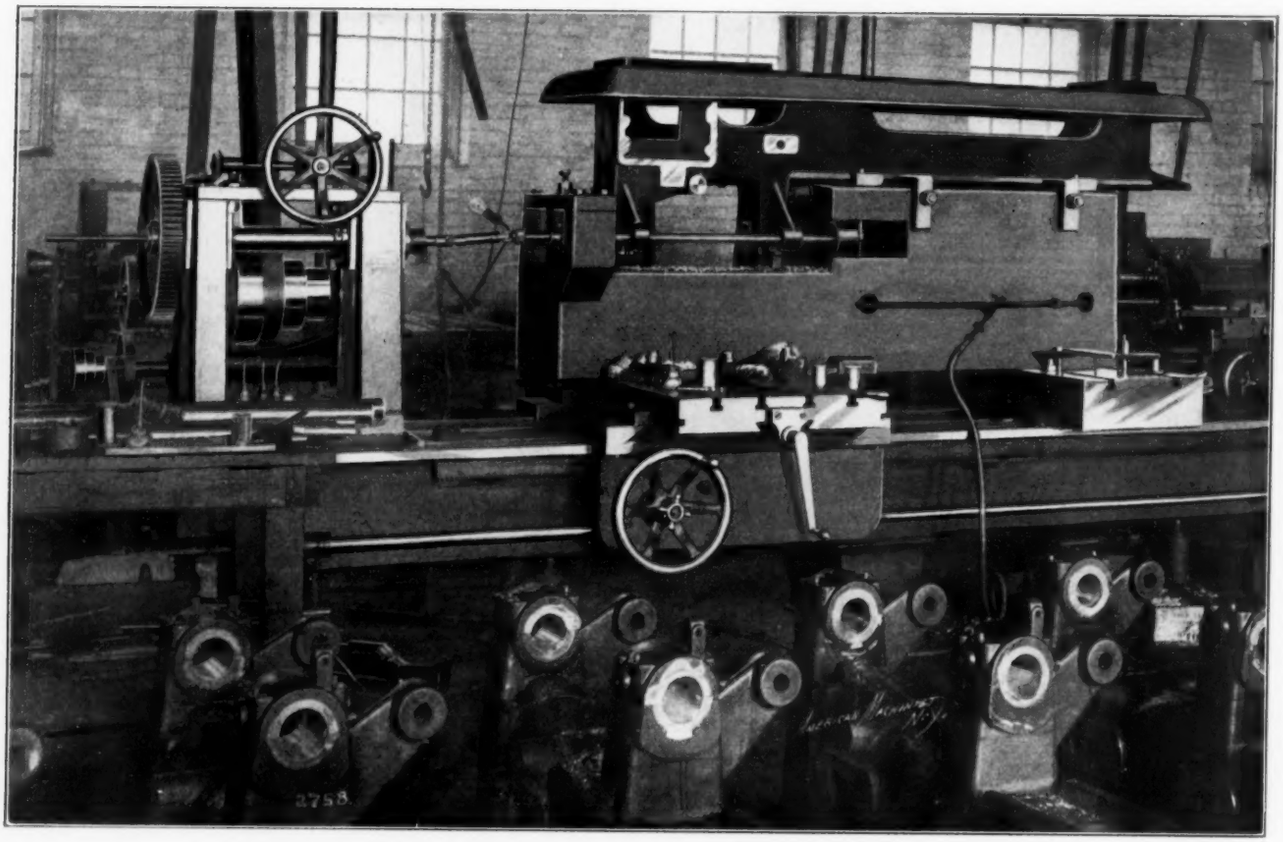


FIG. 4. BORING THE BEARINGS.

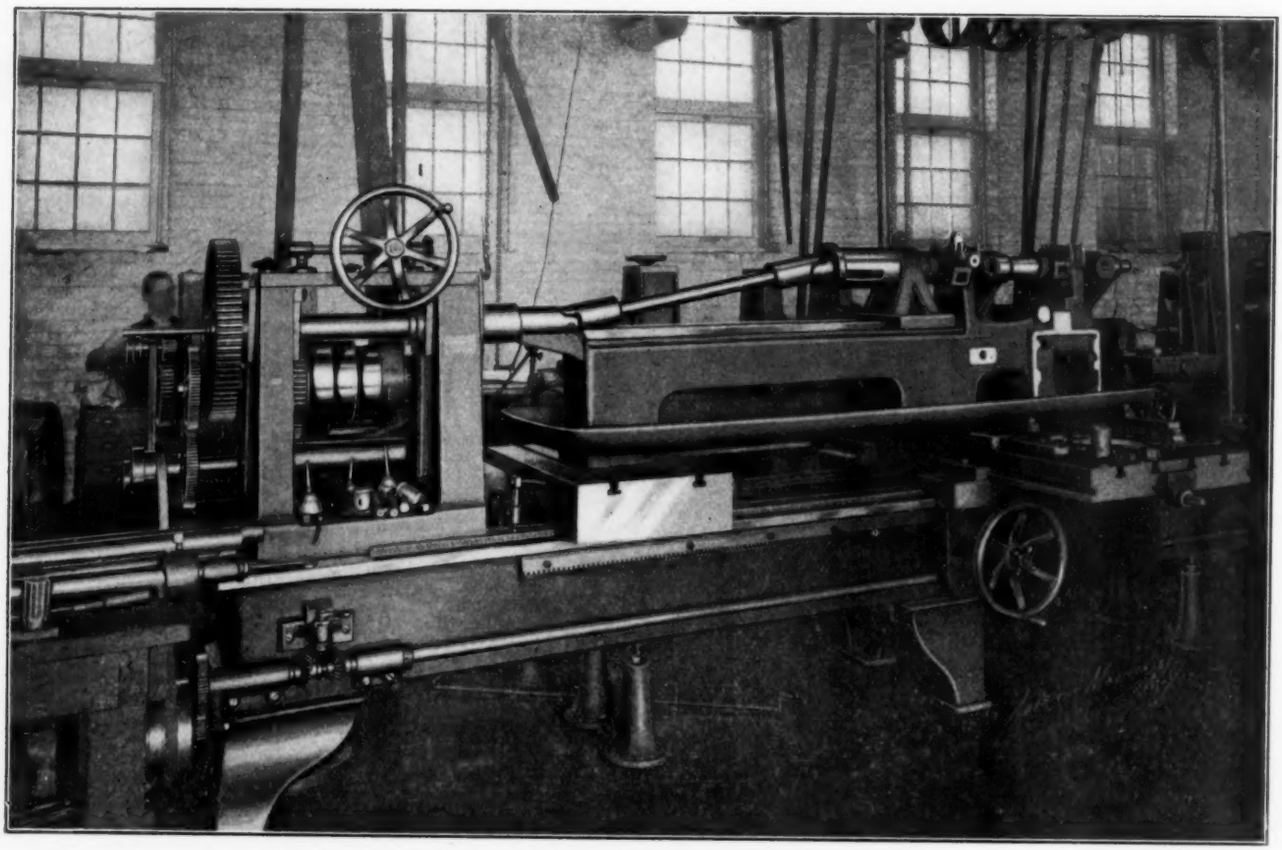


FIG. 5. FACING THE BEARINGS.

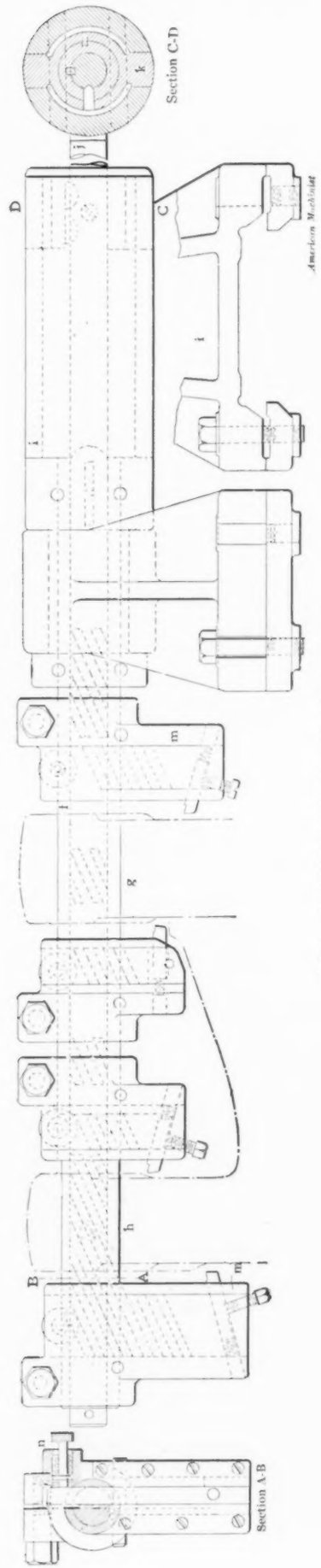


FIG. 7. SHOWING CONSTRUCTION OF FACING-BAR.

the front, and the four hook bolts *c* are simultaneously drawn down on the casting. Upon releasing the air pressure by closing the admission valve and opening an exhaust valve at the end of the pipe, the springs on the bolts throw them up and with clamps *a* drawn back slightly the work may be removed.

The connection between the hook bolts and air pistons *d* are very simple, consisting of two arms *e* each of which is drilled at the ends to receive a pair of the hook bolts and pivoted at the center between lugs formed on the piston above, the lower ends of the cylinders of course being open.

The boring bars for both the spindle and back-gear shaft bearings are guided wholly by the bushings in the fixture and driven from the machine spindle by universal joints, as shown in Fig. 4, so that alinement of fixture with spindle and shears is of no importance whatever.

With the two sets of bearings bored out properly the next operation is to face off the four ends of the spindle bearings. This is accomplished—with the work located as in Fig. 5—with a special four-tool facing bar shown in Figs. 6 and 7, this bar also having a universal drive from the spindle of the boring machine.

The bar proper, *f*, as will be seen by examining the drawing, is hollow from end to end, and at points *g* and *h* fits nicely in the head bearings. At *i* is provided an outboard support which is clamped to the turret machine bed, and which in connection with collars pinned at either side to the bar prevents the latter from moving endwise in its bearings while in action. Passing through *f* is a bar *j* made a sliding fit in the tubular member and milled for the greater portion of its length to a D-section. One end of this piece is equipped with a universal joint for driving and near the same end is keyed a crosshead *k* adapted to slide in longitudinal grooves formed in a sleeve *l* pinned to the hollow cutter bar. The flat surface formed by milling *j* nearly to the center is provided, as indicated, with four groups of teeth cut at an angle of about 25 degrees; and each of the four heads *m* pinned to the bar has a tool slide with teeth cut obliquely to engage those on *j* when the facing tools are to be thrown into action.

Now it is evident that when shaft or rack *j* is driven it will rotate the cutter bar with its four heads, and at the same time any end movement which it may be given relatively to the cutter bar, will cause the facing tools to be fed transversely so long as the angular rack teeth are engaged.

The groups of teeth on rack *j* are just long enough to traverse each tool from the outside of the boss on the head to a point just inside the bore. As each cutter finishes its work and enters a shallow clearance groove in the bar, the engaging rack teeth just pass free of the teeth on the tool slides, and a spring pin *n* in each head then keeps each slide from shifting, until the rack is drawn back and the device reset for the facing operation on the next head.

In this particular instance the rack *j* is not moved endwise, the work and cutter bar instead being traversed automatically by the carriage feed. When used on a boring machine having spindle travel, however, the work of course remains stationary while the rack is fed through the cutter bar.

The inside of the nose of the spindle for this type of turret lathe has to be ground out accurately at two different diameters to receive a hardened steel member serving as a chuck closer. To accomplish this properly it is done with the spindle running in its own bearings, a special grinding attachment being used which is clamped on the bed after the ways have been scraped. This attachment is shown in operation in Fig. 8. It has a belt-driven wheel spindle and a belt-driven feed mechanism for the to-and-fro movement of the slide. The reverse at the end of each stroke is secured through clutches operated by compressed air.

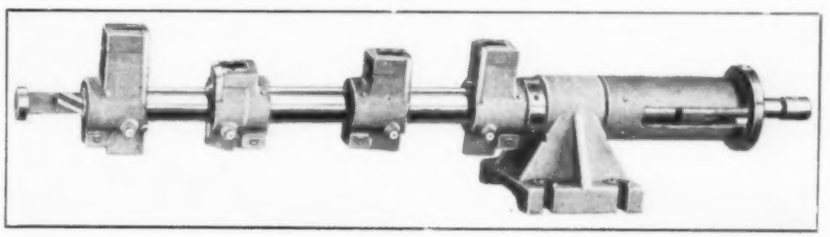


FIG. 6. THE FOUR-TOOL FACING-BAR.

By referring to Fig. 9, showing the construction of the attachment, it will be seen that the driving shaft *o* for the table movement, and a second shaft below, drive in opposite directions through worms which they carry, worm wheels *p* and *q*, either of which may be clutched to pinion shaft *r*. The pinion at the bottom of this shaft meshes with a rack in the base of the fixture, and the upper slide carrying the wheel spindle and feed gearing travels in the direction in which the vertical pinion shaft is rotated.

The clutch body *s* secured to the pinion shaft carries two sliding cones *t* and *u* connected by screws passing through the body; these cone clutches are forced up or down and into engagement with either of the worm gears by compressed air which is admitted to the rear of either clutch through passages formed in the shaft itself. The air supply is through pipe *v*

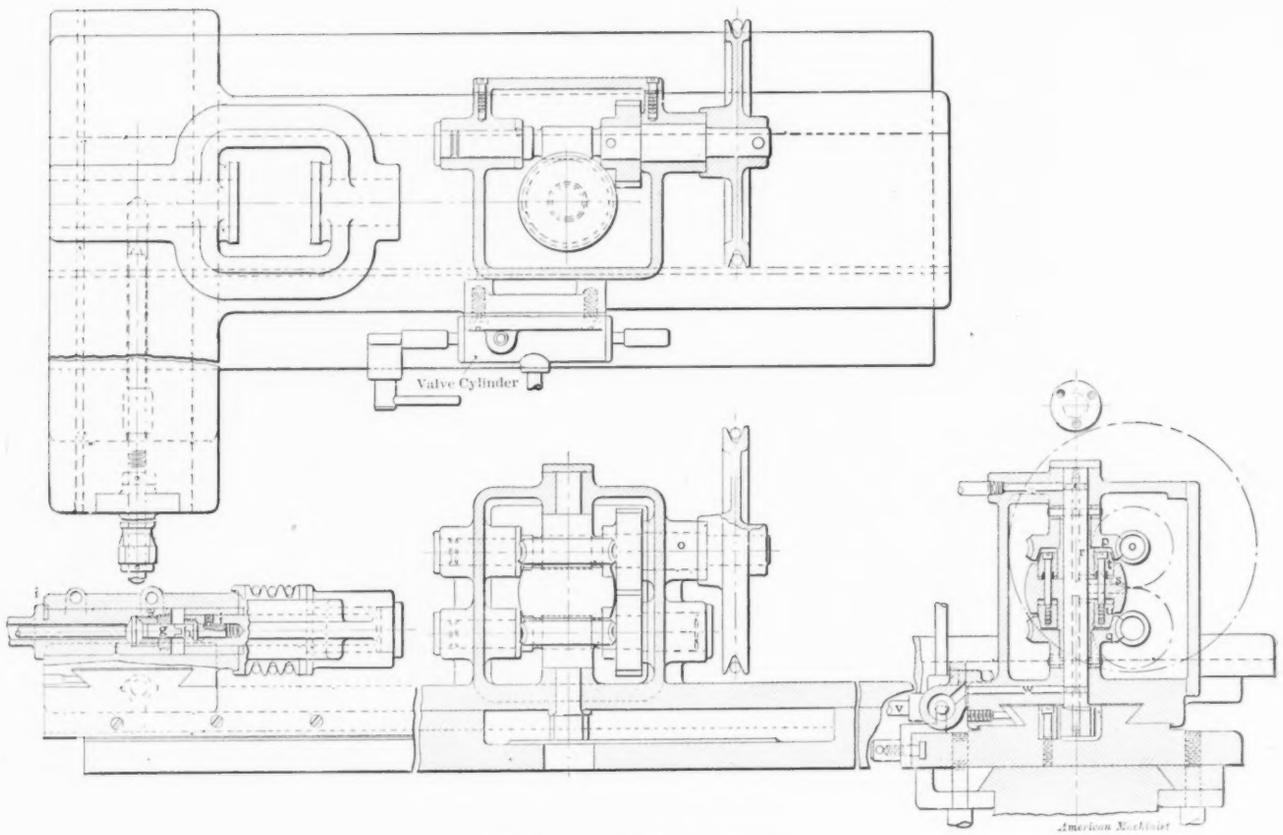


FIG. 9. SPINDLE NOSE GRINDER.

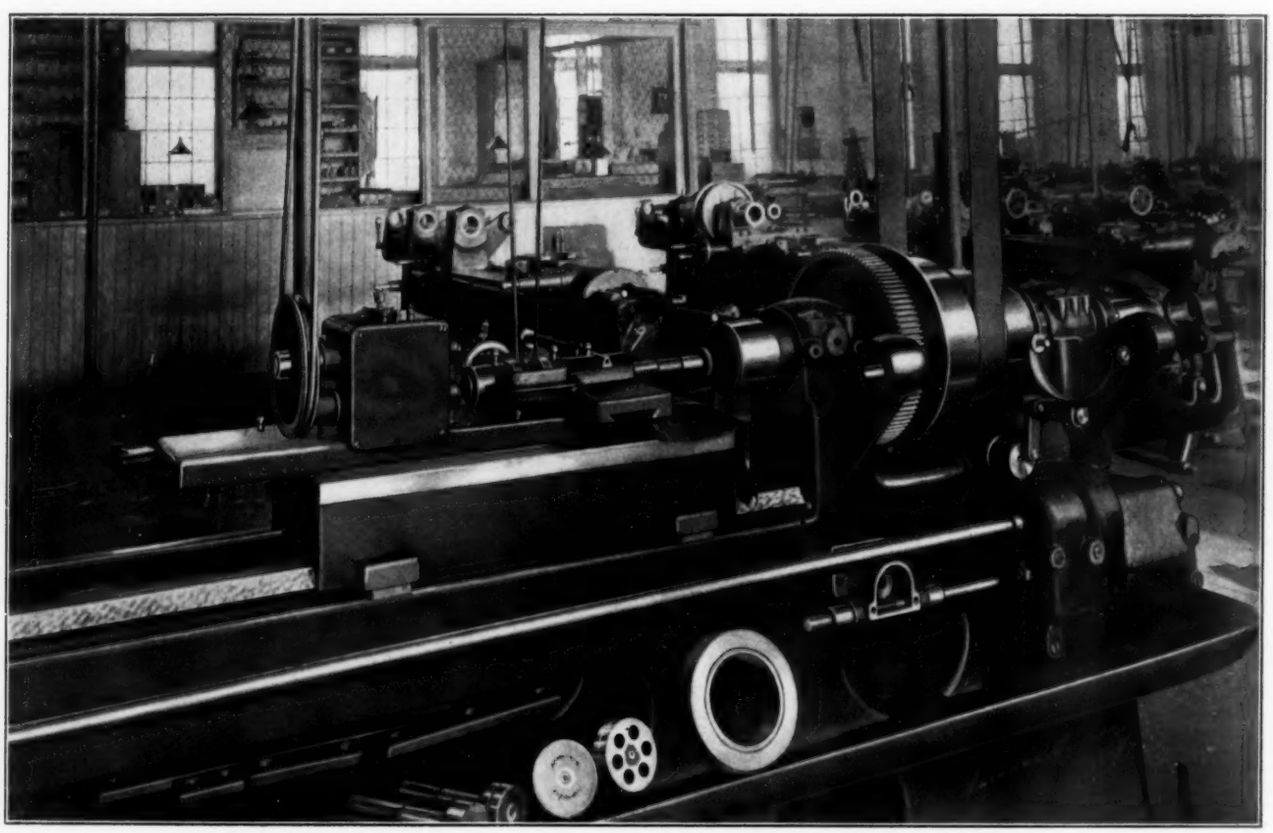


FIG. 8. GRINDING OUT THE SPINDLE NOSE.

connected, as shown, to a valve chest or cylinder from which the air is directed through passages *w* and *x* to clutches *t* and *u* alternately, thus causing the movement of the table to be reversed at predetermined points in the travel.

A longitudinal section through the valve

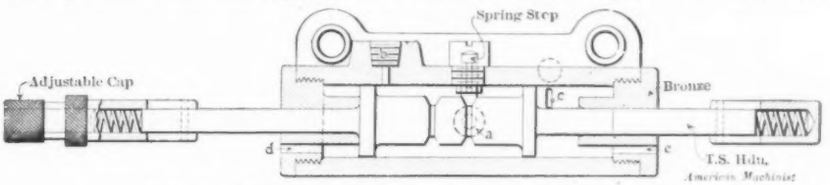


FIG. 10. SECTION THROUGH VALVE CYLINDER OF GRINDER.

cylinder is given in Fig. 10. The spool valve has a stem at either end carrying a spring cap (one of these caps is adjustable) and is moved back and forth in the cylinder, by striking adjustable dogs clamped at the side of the base. It is held lightly either to right or left when shifted, by a spring pin entering one of the shallow grooves formed around the body. In the position shown, air admitted at the point indicated by dotted circle *a* will pass up through a pipe attached at *b*, to passage *x*, Fig. 9, and will then operate clutch *t*, causing worm gear *p* to be the driver for the traversing mechanism. Upon the cap at the leading end of the valve rod striking the dog at that side the valve will fly over to the other end of the chest and the air will then pass through port *c*, Fig. 10, to the under friction clutch in the mechanism and reverse the motion of the slide.

on, the springs under the upper friction hold the friction in mid-position.

This grinding attachment is used on several sizes of machines, and for that reason is fitted with a number of sub-bases to adapt it to various widths of beds and to different spindle hights. The cross movement for the spindle slide by which the wheel is fed to the work is clearly shown and needs no explanation. For different sizes of spindles it is sometimes desirable to change wheel spindles and wheels, and this is accomplished in a very simple manner, the sleeve carrying the grinder spindle being drawn bodily out of its socket and replaced by another carrying the outfit required.

The sleeve and spindle complete are shown in section in Fig. 11. The method

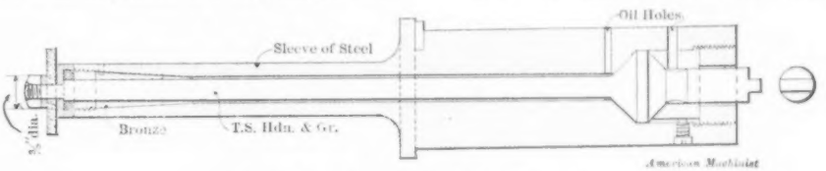


FIG. 11. GRINDER SPINDLE AND SLEEVE.

of attaching to the fixture and driving will be understood from the general drawing, Fig. 9, which shows at *f* the rear end of the sleeve and at *g* the driving end of the wheel spindle. The latter is provided with a tang which slips into a slot in the end of spring plunger *h* feathered in the front end of the main spindle of the grinder head. So, in putting the sleeve in place, it is simply pushed in until the pin *i* at the front end enters a groove in the head—this bringing the oil holes to the top—and then as spindle *j* is turned spring driver *h* snaps over the projection on the end of spindle *g*, thus coupling it to the driving spindle.

The driving and wheel spindle bearings, and the neat method of mounting the gearing and clutches for the traversing mechanism are all brought out plainly in the sectional view in Figs. 9 and 11 and require no description.

In the drilling of the different holes in the turret slides for this type of machine is used a pneumatic jig containing some very novel features of construction. Figs. 12 and 13 represent front and rear views of this jig and the turret slide, and Fig. 14 shows three views of a jig alone. The jig in the drawing is for a different size of slide than the one photographed, but in all important particulars is of identically the same construction.

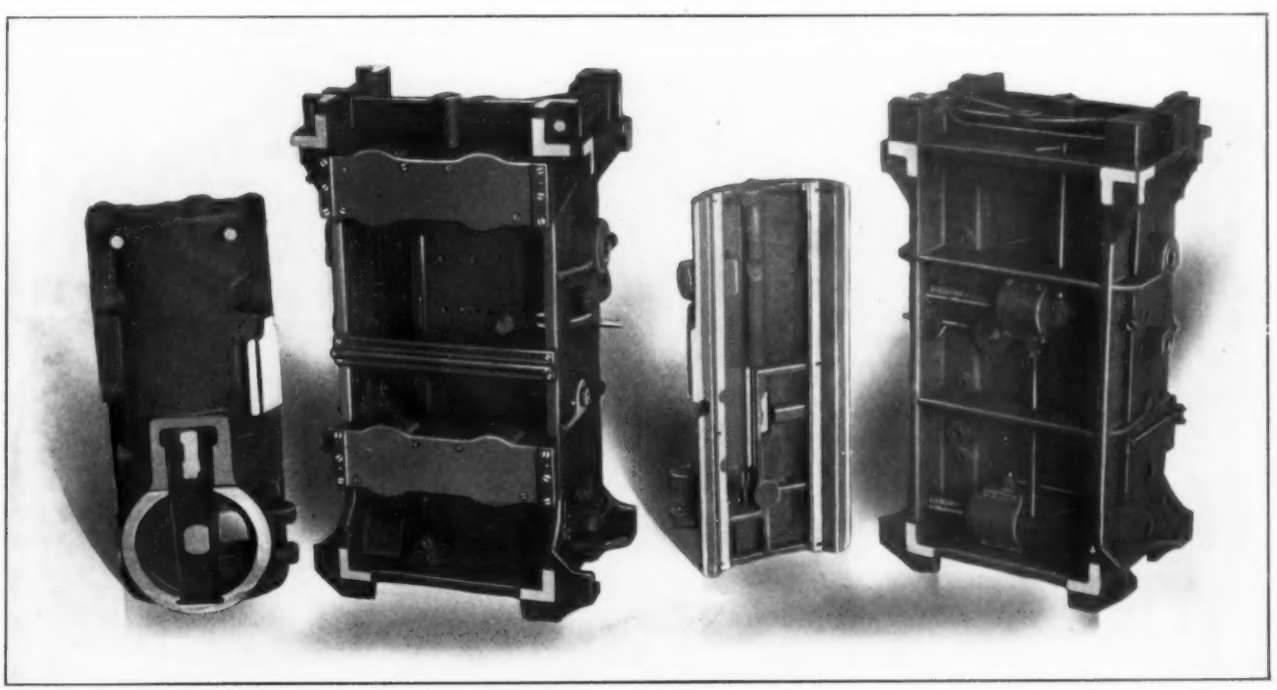


FIG. 12. FRONT VIEW. PNEUMATIC DRILL JIG FOR TURRET SLIDE. FIG. 13. REAR VIEW.

As the air pressure is applied to either member of the double friction clutch, the air against the other member is exhausted through the holes *d* or *e* formed in the valve cylinder heads. With no pressure

The turret slide is already finished on the under side where it fits the ways of the bed, and altho not so represented in the half-tones, is bored out to receive the lower end of the post on which the turret

rotates, the bored hole forming the means of locating the work endwise in the jig. The casting is slid into place by opening the gate or flap at the upper end of the jig, and is located sidewise by one beveled surface only, this locating surface being shown at *a* in the line drawing. The hardened and ground plug at *b*, which positions the slide endwise, fits nicely in the turret post hole and at the bottom is milled off flat on two sides to allow it to slide crosswise in a hardened guide *c*; thus, while determining the longitudinal position of the work, it at the same time allows it to be adjusted sidewise against the surface *a*.

The air hose is connected at *d*, and when valve handle *e* is turned slightly air enters cylinder *f*, and—through pipe *g*—enters also cylinder *h* at the other end of the jig. The piston in each of the cylinders is connected by a rod with a rocker (one of these is shown at *i*), and when air is admitted to the two cylinders these rocker arms are forced against the side of the turret slide, holding it up against the locating surface *a*. After the pistons have moved a certain distance, however, a port in the second cylinder *h* opens and allows air to pass through the piping shown at the side of the jig, to four cylinders *j*, at the front or top, the pistons in these latter cylinders serving to clamp the work securely to its seat while it is being drilled.

When valve handle *e* is turned in the opposite direction it closes the air admission port and connects cylinder *f* with the atmosphere. The air then exhausts from behind the piston in *f* and *h* and the springs on the rods connecting with clamps *i* return the pistons to their original positions and release the side clamps. As the two pistons approach the end of their releasing movement, ports connecting with the piping leading to the four main clamping cylinders *j* open to the atmosphere and allow the air to escape from behind the four pistons, which are then returned to former position by springs located as indicated in the end elevation in Fig. 14.

The two cylindrical plugs at *k* are reversible guides for drilling and reaming a hole through two lugs formed at the front of the turret slide. The two guides are flatted at each end as shown, provided with holes of the correct diameter, and held in alinement by two locating plugs which are kept in place by light flat springs.

The locking bolt for the turret of this machine slides between two hardened and ground steel gibs, each of which has a taper outer edge bearing against a similar surface in the turret slide, and thus providing a means for taking up play in the bolt centrally. The tapered opening thus made necessary will be noticed in the face of the turret slide shown in Fig. 12. To plane the sides of this pocket to the correct angle and at the same time centrally with the turret post hole in the slide, a swiveling fixture is used, the upper member of which is planed to correspond to the turret lathe bed and hence to carry the work properly. This plate for the work is arranged to swing on a pivot to a certain point at either side of the center, and may be positively locked at either side at the right angle by a locating pin. Thus one side of the pocket and then the other is planed out to correct angle and depth; the tool itself being set centrally for the opposite cuts by a plug placed in the hole for the turret post.

The hexagonal turret is bored out taper for the central post and faced at top and bottom in the gray-iron turning department. The disk at the bottom which is to be milled to form a cam for operating the independent stop abutment is also turned here; and after the notched index ring has been secured in place the turret holes are bored out with the turret in place on its slide, and the latter is then put on a special milling machine and the six faces with their beveled edges milled while the turret is held dead true on its saddle by its own locking bolt and index ring.

The cam at the bottom is then cut by mounting the casting on the spindle of the machine shown in Fig. 15. This cam cut-

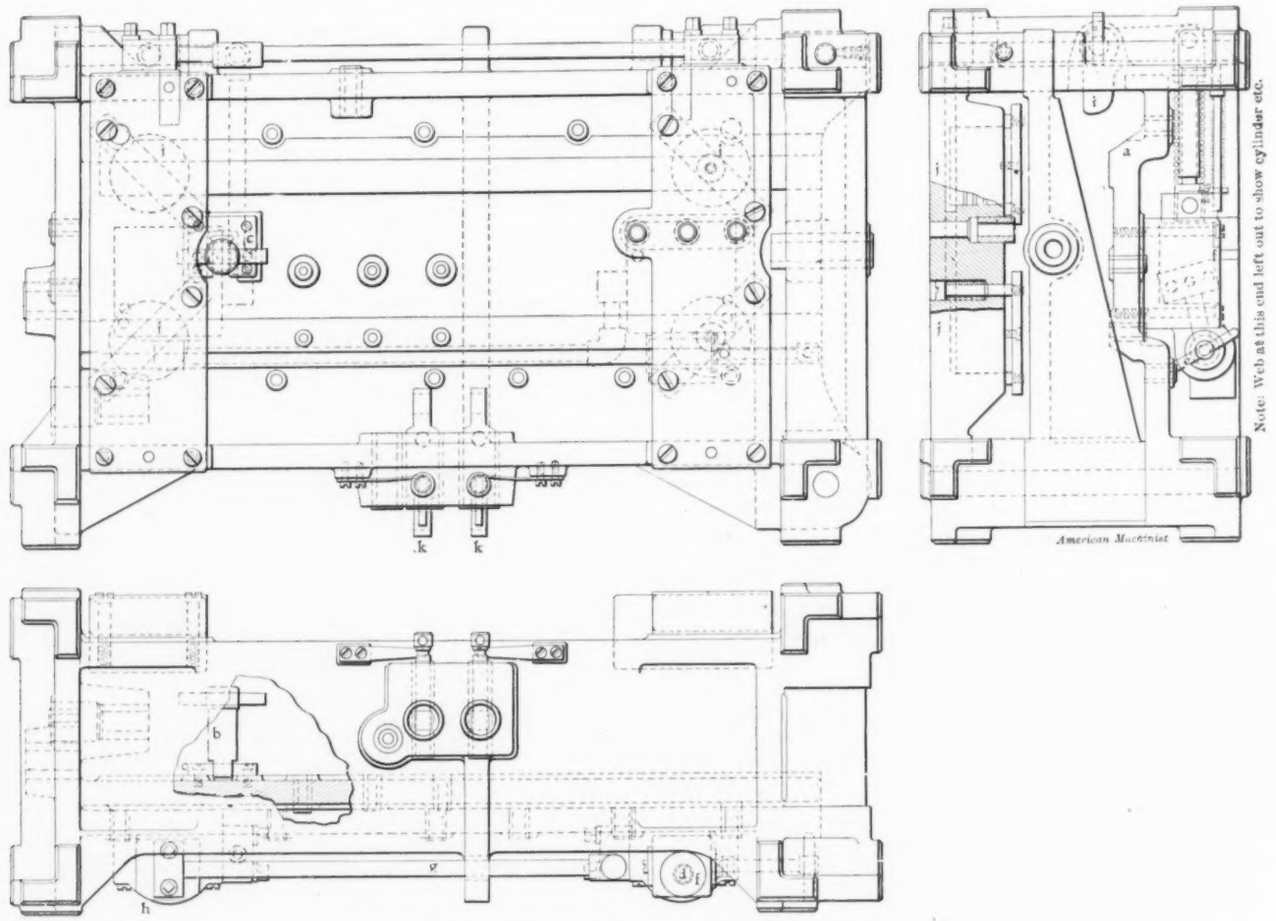


FIG. 14. PNEUMATIC DRILL JIG FOR TURRET SLIDE.

ter was originally constructed for handling a large quantity of cams which had to be made in pairs—right and left—both to be exactly alike. For this work a cam blank was mounted on each end of the double spindle, and a former plate carried at the center was kept in contact with a guide roll mounted in line with the two cutter spindles (one of these is hidden by the head), cutters and roll of course being of the same diameter. In the present work but one casting of course can be milled at a time, and this is held, in the manner indicated, at the end of the work arbor. A former or guide plate is carried on the other end of the spindle, the latter being mounted in a pivoted casting drawn forward by a weighted chain to keep the former plate always in contact with the guide roll, which is carried in this case by the left-hand or idle cutter spindle. The automatic drive or feed for the work is by means of the round belts and grooved pulleys shown and spiral gearing at top and bottom of the pivoted upright member. Hand feed or rotation for the work is secured through the medium of the crank handle located under the head.

F. A. S.

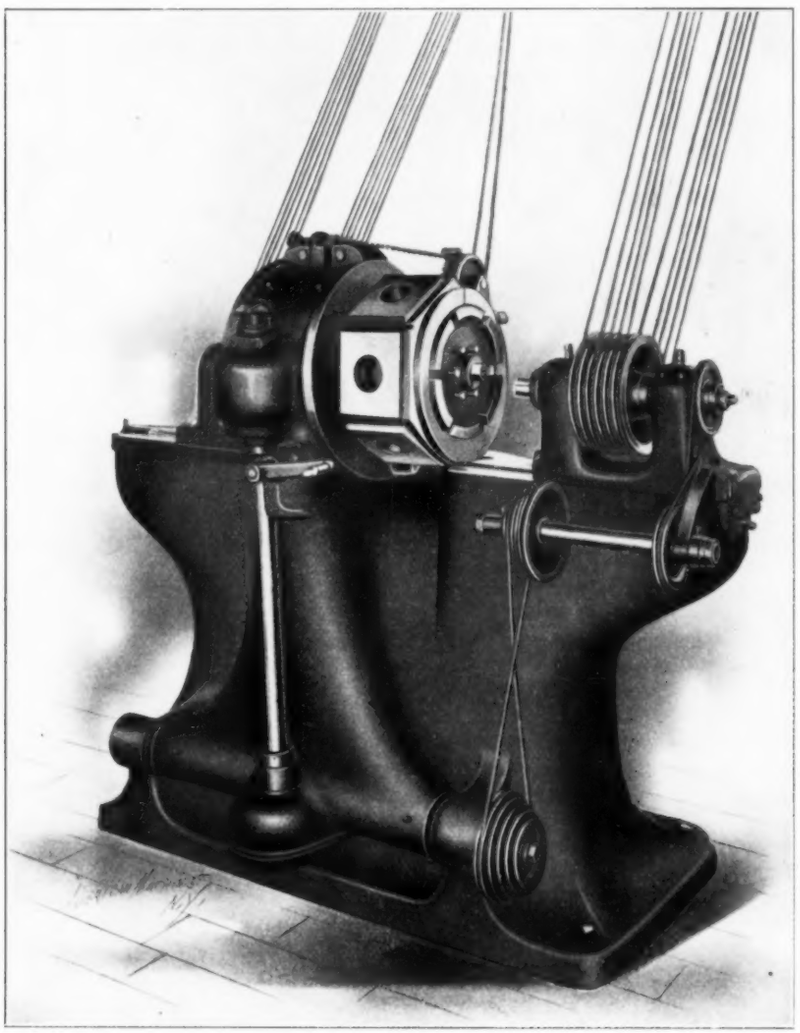


FIG. 15. CAM MILLER.

Factors of Safety.

BY W. H. BOOTH.

The criticism of the statement that a live load produces twice the stress produced by a resting load, which appears at page 345, is only a fair criticism, as applied to such cases as the loading of a bridge. The term moving load has been somewhat crudely and loosely employed.

If a weight of 1 pound be placed slowly and carefully upon a beam of wood of uniform sound texture, it will produce a deflection of, let us say, 1 inch, the weight being, let us say, central. Let the beam be now pulled up by the amount of the 1 inch of deflection by a string, the weight of 1 pound still remaining and being of course entirely carried by the suspending thread. If this thread be burned through, then at the moment it gives way the weight is suddenly applied to the beam, and the deflection of that beam will be 2 inches, and the beam will then fly upward again above its position of no deflection to a distance less than 1 inch, to be followed by a second deflection below normal of less than 1 inch, and so on until the vibration ceases. This is the true idea of a suddenly applied load, and the deflection is always double the permanent deflection caused by the same load when vibration has ceased. If more than double the deflection at rest is caused, the beam has been overstrained and it will not return to its original level. Permanent deflection in a girder may mean nothing but the initial "give" that will occur with any riveted structure.

A moving load, as understood by a bridge engineer, is one that enters upon a structure in a horizontal direction. A moving load produces very little more stress than a resting load upon a long-span bridge, and the slower the movement the less the stress. The reason for this is that when the load enters on the bridge, the bridge at once commences to deflect. As the load advances to positions of successively greater moment the bridge continues to add to its deflection and has already attained almost a maximum deflection before the train has reached the position of maximum moment. In the original illustration the action of gravity is such as to accelerate the applied weight at the rate of 32 feet per second and it can be shown mathematically that this effect will cause a double deflection. In a bridge of, say, 480 feet span a train at a high speed will reach the middle of the span in about three seconds. Yet the bridge will only deflect perhaps a couple of inches, and if it is allowed three seconds in which to deflect this small amount the additional stress due to moving load must be very slight indeed. Seeing that gravity causes a body to fall 16 feet in one second, a deflection of 1 inch at gravity speed means one-fourteenth of a second. In this small space of time a high-speed train would travel 6 feet, or to the center of a 12-foot girder, and the application of such a load would have the full effect of a suddenly applied load. It is all a question of length of span and velocity. Obviously, therefore, different parts of a bridge are to be calculated for load, according to their positions in the bridge. A small percentage only needs to be added to the main girders for moving-load effects. Cross girders which are less than 20 feet apart are practically subjected to load suddenly applied. Similarly, track stringers are exposed to equally sudden applications while the points of connection of the stringers and the cross girders or floor beams are in all cases suddenly loaded, except so far as the stiffness of the rails throws forward a certain premonition of the coming load. All these points have been fully exemplified in practise, for the points of weakness and failure have always been those as to which the time of application is the shortest.

Far more severe stresses may be induced in long-span structures by the cumulative effect of vibration than by any suddenness of application of load. Such vibrations are, or may be, caused by the balance weights in the engine wheels, especially

should these happen to coincide with length of panel. Reverting to the original illustration of the model beam that will deflect 1 inch under a load of 1 pound at rest, if the beam were pulled down by a cord to a deflection of 1 inch, then the application of the pound, no matter how suddenly, would produce no further deflection, and all short bridges could be increased in strength very considerably could they be anchored down, when fully loaded, to the rocks beneath. The bridge would then always carry a constant stress, and the only effect of a load would be to vary the stresses in the anchorage rods. A consideration of these principles may sometimes be of service in machine design.

Excepting only for the very shortest girders, the idea of flying a train over a bridge—Jules Verne fashion—is based on an entire misconception. The only argument advanced to justify the idea is that of rapidly skating over thin ice, the advantage of which, however, lies merely in the fact that the ice cannot break until the water below has got away to one side. It is the inertia of the water that keeps the skater up, and one may skate over ice thinner than will readily allow the skater to scramble upon it from the water. This I have proved, not intentionally. The ice problem, however, is entirely distinct from that of the bridge.

Generally it should be understood that the increase of stress caused by a moving load over the stress caused by the same load at rest is entirely a question of the work done by gravity during the deflection of the loaded structure.

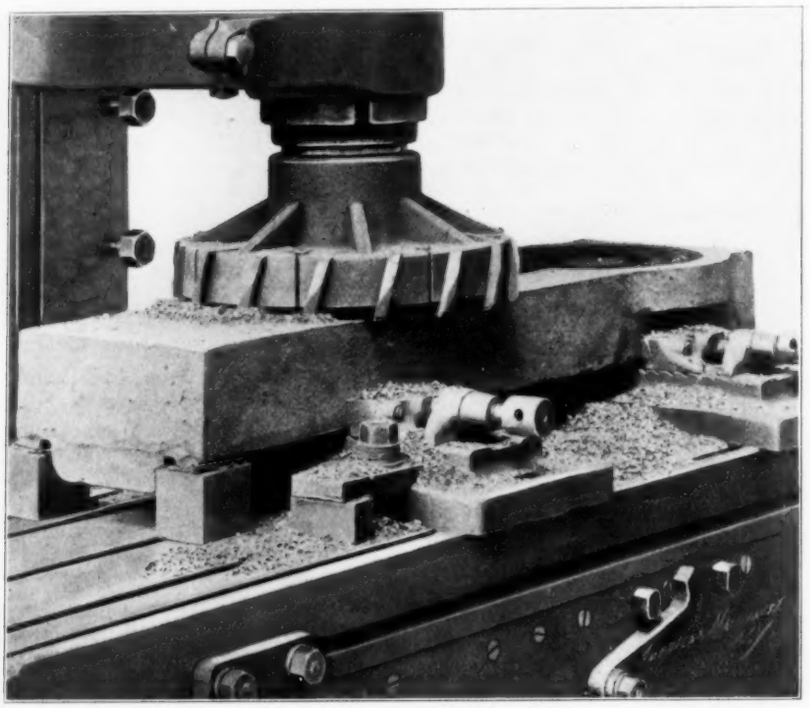


FIG. 5. MILLING WITH HIGH-SPEED INSERTED TOOTH CUTTERS.

English Results With High-Speed Steel—II.*

The original paper concludes with a long appendix consisting of letters giving the experience of users of the steel from which we extract the following.—Ed.

From Alfred Herbert, Coventry:

Fig. 5 shows a vertical milling machine with face milling cutter 12 inches diameter with 16 inserted teeth made of "A. W." steel; cutting speed, 75 feet per minute; depth of cut, 5-32 inch; width, 11 inches; feed, 7.5 inches per minute.

Fig. 6 illustrates our method of turning cone pulleys with "A. W." steel. This photograph was taken while the lathe was cutting at a speed equal to 120 feet per minute on the big step of the cone pulley.

Fig. 7 shows a combination turret lathe at work with 1¼-inch "A. W." drill. In this case the penetration was equal to 1 inch in 28 seconds. The large cuttings which are seen on the rest underneath the work did not come from this drill, as is of course obvious, but from counterboring tool.

Other jobs are as follows:

Rough turning capstan lathe spindles with "A. W." steel on 12-inch lathe. Cutting speed, 58 feet per minute; depth of cut, ⅜ inch; feed, 16 cuts per inch.

The above spindles were made of steel containing .5 per cent. carbon. The tool was lubricated with a liberal supply of suds. The limit of the work in this case was the lathe and not the tool. At another test the same work was done at 63 feet per minute; cut, ⅜ inch deep; feed, 32 cuts per inch.

Boring lathe spindles out of the solid bar with "A. W." flat cutter. The material from which these spindles are made contains .5 per cent. carbon. Diameter of holes, 3 9-16 inches. Bored out of the solid at 64 turns per minute = 60 feet per minute. Feed, 85 cuts per inch, 45 inches per hour.

Pulley turning with "A. W." steel tools. Roughing out, 60 feet per minute; cuts, 3-32 inch deep; feed, 3-32 inch per inch; finishing cut, 100 feet per minute; cut, 1-32 inch deep; feed, 36 cuts per inch. The pulleys in question are very thin, and will not stand a heavy cut.

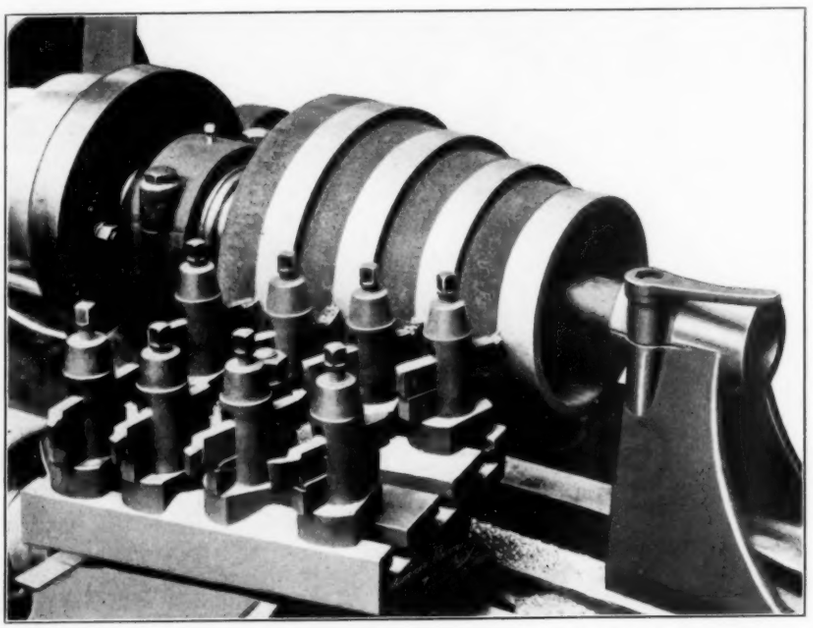


FIG. 6. TURNING CONE PULLEYS WITH HIGH-SPEED STEEL.

*Abstracted from a paper read before the Coventry Engineering Society by J. M. Gledhill, of Sir W. G. Armstrong, Whitworth & Co.

Milling medium gray iron with face-milling cutter 4½ inches diameter, with 14 inserted teeth made of "A. W." steel, cutting at 70.7 feet per minute. Depth of cut, 5-32 inch; width of cut, 3 inches; feed, 8½ inches per minute.

Milling medium gray iron with face-milling cutter 12 inches diameter, with 16 inserted teeth made of "A. W." steel, cutting 75 feet per minute. Depth of cut, 5-32 inch; width, 11 inches; feed, 7.5 inches per minute.

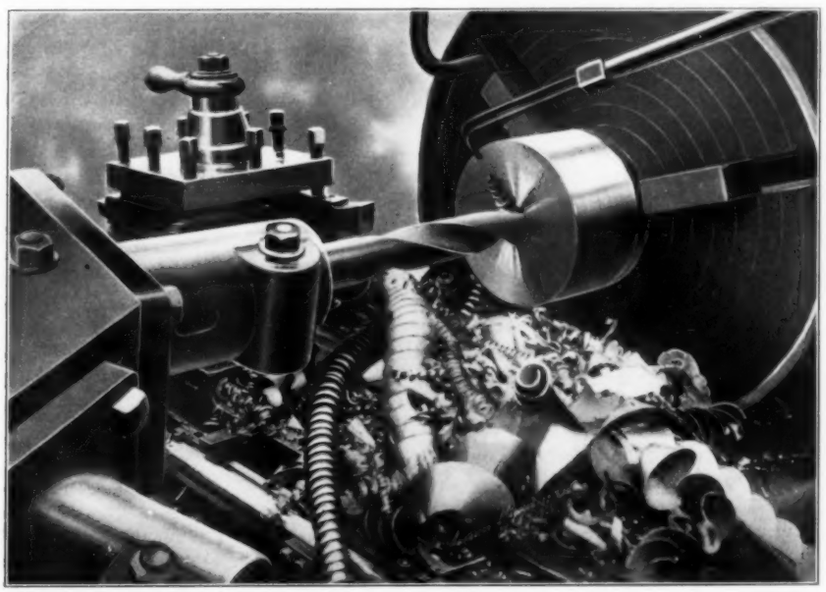


FIG. 7. DRILLING WITH A TWIST DRILL OF HIGH-SPEED STEEL.

Milling medium gray iron with face-milling cutter 9 inches diameter, 12 inserted teeth made of "A. W." steel, cutting at 80 feet per minute. Depth of cut, ⅛ inch; width of cut, 6 inches; feed, 8½ inches per minute.

Cylindrical cutter milling mild steel. Cutter made from "A. W." steel, 2¾ inches diameter, 21 teeth, running at 72 feet per minute. Depth of cut, 5-32 inch; width of cut, 3 inches; feed, 7½ inches per minute.

Gear cutting, 5 pitch. Stocking cutter, 3½ inches diameter, cutting gray-iron spur gear from solid. Cutting speed, 75 feet per minute; feed, 14 inches per minute.

At the time the observation was made 2,580 teeth, 2¼ inches long, had been cut. The cutter appeared to be in as good condition as after cutting the first 100 teeth (7 hours nearly).

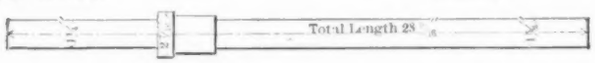
Figs. 8 to 13, inclusive, are not intended to illustrate the largest amount of metal which can be removed in a given time regardless of finish, but what we consider to be a good time for producing a good job. All the reductions on the samples were taken at one cut; no finishing cut was taken, and no filing or polishing was used.

Figs. 14 and 15 show two samples of rough bolts produced with high-speed steel. Fig. 14 was made upon our No. 2b hexagon turret lathe in 5 minutes 28 seconds, using "A. W." tools. The following are the details:

	min.	sec.
Reducing 1⅞-inch bar to 1 inch, 6 inches long, 96 cuts per inch.	4	0
Screwing		40
Cutting-off		28
Idle movements, etc		20
Total	5	28

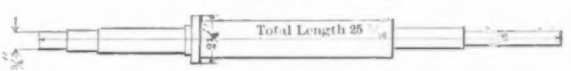
The above time does not include the facing of the back of the head, which would require another ½ minute.

This bolt, made in the ordinary way with ordinary tool steel, with a good operator, requires 15 minutes.



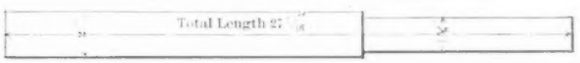
Time 3⅞ minutes. Cutting speed, maximum 49.5, minimum 25.4 ft. per minute. Feeds 92 per inch, traverse 1 in. in 1 minute 11 seconds.

FIG. 8



Time 45 minutes. Cutting speed, maximum 37.6 minimum 12.5 ft. per minute. Feeds 94 per inch, traverse 1 in. in 1 minute 26 seconds.

FIG. 9

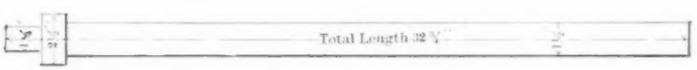


Time 23 minutes, 40 seconds. Cutting speed, maximum 58.5, minimum 47.6 ft. per minute. Feeds 92 per inch, traverse 1 in. in 1 minute 49 seconds.

FIG. 10

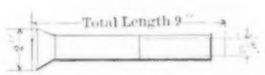
Time 21 minutes. Cutting speed, maximum 50.1 minimum 27.4 ft. per minute. Feeds 92 per inch, traverse 1 in. in 39 seconds.

FIG. 11



Time 33½ minutes. Cutting speed, maximum 41.8 minimum 20.9 ft. per minute. Feeds 92 per inch, traverse 1 in. in 58 seconds.

FIG. 12



Time 13 minutes. Cutting speed, maximum 58.5 minimum 27.4 ft. per minute. Feeds 92 per inch, traverse 1 in. in 49 seconds.

FIG. 13

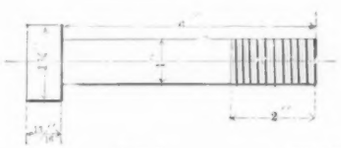


FIG. 14.

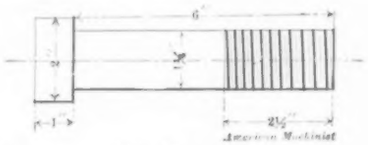


FIG. 15.

EXAMPLES OF WORK BY ALFRED HERBERT.

Milling medium gray iron with the same face cutter as the above, cutting at 75.4 feet per minute. Depth of cut, ¼ inch; width, 5 inches; feed, 7.57 inches per minute.

Cylindrical cutter milling mild steel. Cutter 3 inches diameter, 10 teeth, running at 70 feet per minute. Depth of cut, 5-32 inch; width, 11 inches; feed, 3 inches per minute.

Fig. 15 was made with a special tool and holder, using two "A. W." tools, one at the front and one at the back, and was intended to determine what could be done in the way of producing a rough bolt

quickly. The total time was 2 minutes 18 seconds, made up as follows:

	min.	sec.
Turning, speed 144 feet, feed 33 per inch	1	25
Screwing		23
Cutting-off		30
Total	2	18

The steel is ordinary black bar in both cases.

From the British Westinghouse Electric & Manufacturing Company, Trafford Park, Manchester:

Warner & Swasey hexagon turret lathe. Tool, roughing ½x1-inch section; operation, reducing a 1¾-inch reeled steel bar, about .1 per cent. carbon, from 1¾ inches diameter to ¾ inch diameter; cutting speed, 38 feet per minute; feed, 100 revolutions per 1 inch of feed. The tool lasted for over 46 hours before regrinding was required.

Tool, ¼x½-inch section; operation, boring steel wiper rings for railway motors; cutting speed, 35 feet per minute; feed, 40 revolutions per 1 inch (this is equivalent to about 1 inch per minute); reducing 3-16 to ¼ inch on each side of the hole. The tool stood for 10 days without regrinding, and was still in good condition.

Tool, steel angle cutter, 50-12; operation, milling tool steel; cutting speed, 72 feet per minute; feed, .03 inch, or 2.7 inch travel per minute; depth of cut, 5-16 inch. The cutter worked for 3 hours, and was then in such good condition that the speed was put up to 84 feet per minute, and the feed to .036 inch, or 3.8 inches travel per minute. The cutter then stood for 8½ hours before it required regrinding.

Tool, ¾-inch drill; operation, drilling gray iron 4 inches thick; revolutions, 360 per minute; feed, 60 revolutions per 1 inch of feed. One hundred and thirty-seven holes were drilled before the drill required regrinding.

Tool, 1-inch drill; operation, drilling gray iron 4 inches thick; revolutions, 250 per minute; feed, 60 revolutions per 1 inch of feed. Seventy-eight holes were drilled before the drill required regrinding.

Tool, ¼ inch square section; operation, reducing C. R. S. by 3-32 inch in diameter; cutting speed, 160 feet per minute; feed, 2¾ inches travel per minute. The tool lasted 23 hours before requiring regrinding.

From Sir James Farmer & Sons, Salford:

With "A. W." steel we have bored a 3-inch hole from a billet of mild steel, .25 carbon, the hole being bored at one operation with an ordinary drill-shaped bar, bored at a rate of speed slightly exceeding 12 inches per hour, no lubrication being used, and the drill being in excellent condition after boring the hole nearly 7 feet long without once regrinding.

The second item of interest is the turning of a gray-iron drum, 12 feet diameter by 5 feet face; this was turned from the black at a speed of about 35 feet per minute. The second cut was made at a speed of 50 feet per minute; depth of cut, ⅛ inch, with 1-12 inch traverse. In this instance the tool completed the entire surface of the drum without once regrinding, and was in excellent condition at the termination of the work. We have also done two similar cuts over a drum of exactly the same diameter as above with the *same tool, without regrinding from start to finish*, at a speed of 50 feet per minute and without losing 1-64 inch in girth on the drum during the operation (27¼ hours' actual cutting).

Football and the English Workman.

Walter C. Hamm, United States Consul at Hull, England, sends the following to *Consular Reports*. The matter referred to is certainly deserving of serious consideration by those who are studying and aiming to promote industrial efficiencies. The conditions as stated show a vast difference between the habits of English and of American workmen.

In England, says Mr. Hamm, it is not the college students, but the workingmen, who, it is claimed, are injuriously affected by football. Two articles touching on this subject have recently appeared in English magazines, and the view they take of the question may be of interest to the American public. The first is from the *New Liberal Review* and cites the tendency to football and other sports as one of the signs of the "decay of industry." The following is a pertinent extract:

"Despite the modern talk about the dignity of labor, in practise the workingmen evince but scant respect for labor as such. All over the country the evidence accumulates that they are the victims of the present-day tendency to leave work to take care of itself so long as ever-increasing opportunities can be secured, not for rational leisure, but for pleasure seeking. The Saturday half-holiday is coming to be supplemented more and more by a 'day off' on Monday, and Monday football matches are now a recognized institution. The occurrence of bank holidays is made the occasion of a suspension of work during several days following, and everybody knows to his cost the difficulty, if not the impossibility, of getting any work done for at least a week after the holidays. The observance of Mabon's day—a monthly whole holiday—in Wales has long been a standing grievance to the employers of men for whom the claims of their work seem to rank after all others. No reasonable or fair-minded person will grudge a generous allowance of holidays to the toilers and the breadwinners. But it is a just cause for censure that work should be held in such low esteem that any and every excuse should be deemed good enough for setting aside its obligations."

The second article appeared in *Macmillan's Magazine* for February, and is directly to the point. These extracts will be found interesting:

"Large employers of labor in Yorkshire, in Lancashire, in Durham and in Northumberland, as well as in the Midlands, have been obliged to yield to the rush of the tide and are powerless to command the interests of business against those of football. Momentous events, such as the launching of a ship or the completion of an important order within contract time, have frequently been delayed by the coincidence of a "cup tie." Large establishments are occasionally closed in midweek because the whole body of workmen take it into their heads that their pets on the football grounds require encouragement. If these men were ordinary hewers of wood and drawers of water a remedy might be found, but they are chiefly skilled laborers—earners of good wages—who need never be out of work, and who, if turned off, would be eagerly snapped up by a rival.

"Persuasion is useless, for money is no object to men who can make their £3, £4 and £5 ($14.60, $19.47 and $24.33) for a week of five days; resistance is worse than useless; so the tyrannized employers have, in their own interests, actually to encourage what in their hearts they detest. Thus, as I have been told, a large shipbuilding firm in one of our northeastern ports has been forced to find good berths for a couple of first-rate football players during the summer months, merely to retain their services for the local club and to prevent them from being tempted away by a rival. If a man or a half dozen men are absent from their posts on a Wednesday or a Saturday nobody asks where they are, or if they are ill or dead; it being taken for granted that football somewhere has attracted them away. To ask leave of absence is, of course, an archaic superfluity. Jamie or Georgie wants to be at a certain game; he goes, and there is no more to be said about it."

It must be remembered that football in England is largely professional, as baseball is in the United States, and that it is played six or eight months in the year and not confined to two months in the autumn. There are intercollegiate and interschool matches, but the chief interest in the game centers in the matches played by the professional teams. The interest felt in the game can be measured by the attention given it by the newspapers. Every day the announcement of games to come, and the reports of games played the previous day, occupy several columns in the leading newspapers, and the Saturday games demand a page and a half in Monday morning's newspapers.

The latest mechanical wonder that we read about—and not in a daily newspaper, either—is a reciprocating engine 40 feet in diameter and weighing 980,000 pounds.

Powdered Coal for Steel Annealing.

BY H. J. TRAVIS.

Among the various uses to which powdered coal as a fuel has been recently applied, we find an interesting instance at one of the largest works of the United States Steel Corporation. An annealing furnace for steel castings is there now heated with this fuel instead of oil, the latter having been used for several years.

A pulverizing apparatus as shown in the half-tone was installed in front of one of the annealing furnaces, and experiments were begun to determine the availability of this system for this purpose. This machine pulverizes and feeds the coal and furnishes the necessary air for complete combustion. Feeder, pulverizer, fan and a steam turbine are mounted on one shaft, the turbine driving the revolving parts about 2,500 revolutions per minute, giving the pulverizing bats a speed of about 11,000 feet.

A small quantity of kindling placed in the furnace serves to ignite the incoming cloud of coal dust and air, thereby producing a high temperature. The tables give the results of observations and tests of an annealing furnace in the steel mill of the foundry of these works, using pulverized coal as fuel.

The furnace was charged with steel castings of various sizes, aggregating in weight 22,602 pounds. From the time that the powdered coal feeder started to the end of the heat, 1½ hours elapsed. Three hundred pounds of wood was used in starting the fire. To obtain the necessary draft at the furnace to carry off the gases of combustion, a small jet of steam was used in the stack. The steam consumption of turbine for driving the apparatus and the blower was accurately determined and was used as a basis for the calculations for the following results:

Total time of annealing from starting of fire—1.5 hours.

Total weight of castings annealed—22,602 pounds.

Total coal burned—796.5 pounds.

Total amount of steam used by turbine and blower—1,930.5 pounds.

Coal burned per hour—531 pounds.

Steam used by turbine and blower per hour—1,287 pounds.

Coal used per ton (2,240 pounds) of steel annealed—78.8 pounds.

Steel annealed per pound of coal burned —28.3 pounds.

Steam used per ton of steel castings annealed—192.8 pounds.

TURBINE AND BLOWER.

Average revolutions per minute—2,570.

Average pressure on turbine nozzles—85.4 pounds.

Steam used per hour by blower—33 pounds.

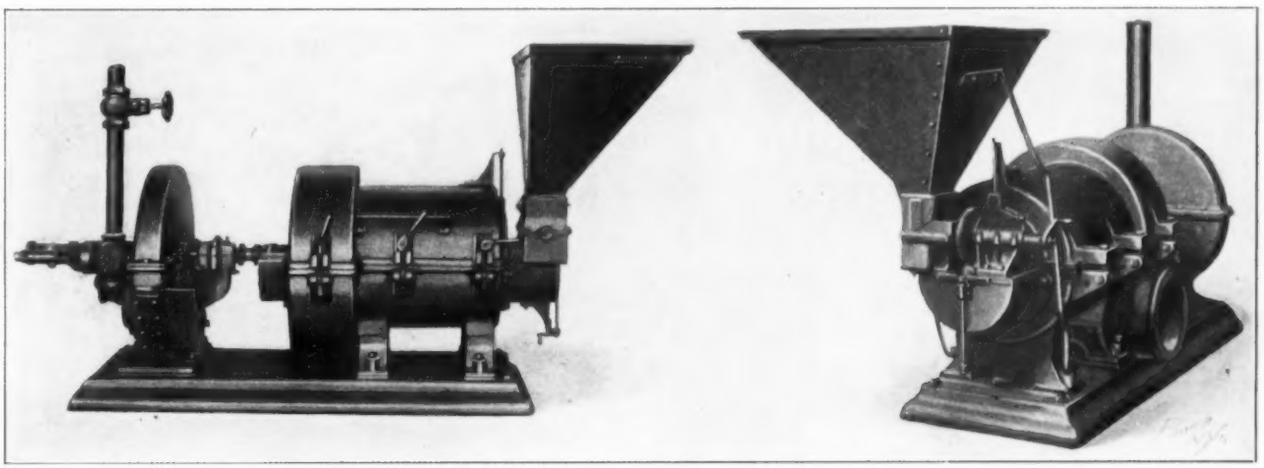
Steam used per hour by turbine—1,254 pounds.

Boiler horse-power to supply steam for blower—1.12.

Boiler horse-power to supply steam for turbine—42.67.

Total horse-power required—43.79.

Total boiler horse-power per 100 pounds coal burned per hour—5.49.



COAL PULVERIZING AND FEEDING APPARATUS.

Pressure in furnace with blower on—.10 inch.

Pressure in furnace with blower off—.05 inch.

TEMPERATURES IN FURNACE BY ELECTRICAL PYROMETER.

The positions of holes in furnace walls through which temperatures were taken were arranged and numbered beginning at the side nearer the apparatus or delivery tube, and the last, No. 4, beyond the stack, No. 3 being nearer the uptake and showing the highest temperatures.

Time of Taking Temperatures.	1	2	3	4
	°F.	°F.	°F.	°F.
10.48 A.M to 10.55	1025	1200	1275	1050
11.05 " " 11.10	925	1250	1350	975
11.19 " " 11.23	1000	1350	1500	950
11.40 " " 11.45	1025	1350	1525	960
11.59 " " 12.03	1250	1450	1500	1200

It will be observed that the furnace is hotter at the end farthest from the stoker and nearer to the stack; on this account it may be well to put the largest castings in this end, to secure a more uniform annealing.

Fifteen minutes after starting the stoker, the furnace was filled entirely with a reddish yellow flame which seemed to come in contact with all parts of the castings. The maximum observed temperature did not rise above 1,525 degrees Fahr. This comparatively low temperature is no doubt caused by the flame coming in contact with the steel castings, as this same machine has stoked dust in a boiler furnace effecting a temperature of 3,800 degrees Fahr. The residue in the bottom of the furnace after the heat was found to be a brown powder containing no combustible matter. Gas analysis of samples taken from the furnace showed the combustion to be good.

Average analysis:

CO_2	14.4 per cent.
O	3.2 "
CO	1.2 "

A certain amount of CO would be expected in a gas containing as high a percentage of CO_2.

Analysis of coal used was as follows:

Moisture	.5 per cent.
Volatile matter	21.0 "
Fixed carbon	69.3 "
Ash	9.2 "
Sulphur	.72 "

Comparison of the cost of annealing with oil and powdered coal:

PULVERIZED FUEL.

Taking the cost of coal at $2.75 per ton and a boiler horse-power year (7,200 hours) at $45, the cost to anneal one ton of castings (2,240 pounds):

For coal alone	$.097
For steam (turbine and blower.)	.041
Total	$.138

OIL.

With the oil annealing furnace the average weight of castings charged was about 4½ tons; to anneal this, three burners

were used for ten hours. Cost to anneal one ton (2,240 pounds) of castings:

For oil alone	$1.30
Compressed air to vaporize oil	.45
Total	$1.75

From the above, the cost of annealing

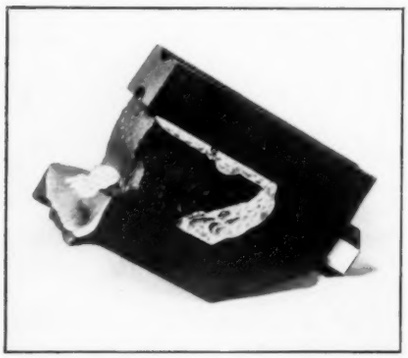


FIG. 1. THE BROKEN TOOL.

by pulverized fuel is 7.87 per cent. of that for annealing with oil.

The steam consumption of the apparatus has been charged as given by the engineers of this company, but there is some error in the figure, "1,254 pounds per hour," as given as consumed by the turbine, as it impossible to blow this amount of steam per hour through the six nozzles at 85 pounds pressure. This error no doubt has been made in separating the steam used by blower from that used by the turbine, as numerous tests in boiler practise have shown a steam consumption of from 480 to 500 pounds per hour when pulverizing 550 pounds of coal and develoing 9 turbine horse-power; the total steam per hour, however, 1,287 pounds, is correct.

FIG. 2. WELDED CHIPS.

On account of changes in uniforms the U. S. A. Quartermaster-General has advertised for proposals for converting 8,000 gross of gilt buttons into dull finished bronze buttons. The buttons are to be electroplated with copper before bronzing.

A British Foundrymen's Association.

We learn from *The Engineer*, London, that there has been formed an association of managers, foremen and others in responsible positions, engaged in or in contact with foundry work or the study and manipulation of metals. The association will follow in some degree the American Foundrymen's Association, "which has done such satisfactory work in the past, and has given a great impetus to scientific thought as applied to foundry operations." The proceedings of the association will be both scientific and practical, and, it is hoped, educational in the best sense. Papers bearing upon varied aspects of the foundry business will be read and discussed. Leading scientists and metallurgists, as well as practical men, will be invited to contribute to the usefulness of the meetings.

The president is Robert Buchanan, 35 Thornhill road, Handsworth; the secretary and treasurer, F. W. Finch, Kingston House, Lansdown road, Gloucester. Committee: C. Morehead, Rugby; F. C. Shaw, Birmingham; Percy Longmuir, Sheffield; William Vickers, Birmingham; J. Ellis, Woolston, Hants; J. G. Stewart, Urmston, Lancs.; F. J. Cook, Birmingham; W. Roxburgh, Kilmarnock. The convention will be held annually, the place of meeting being changed from year to year. Opportunity will be sought to visit representative works in the several districts. Further information can be had from the secretary.

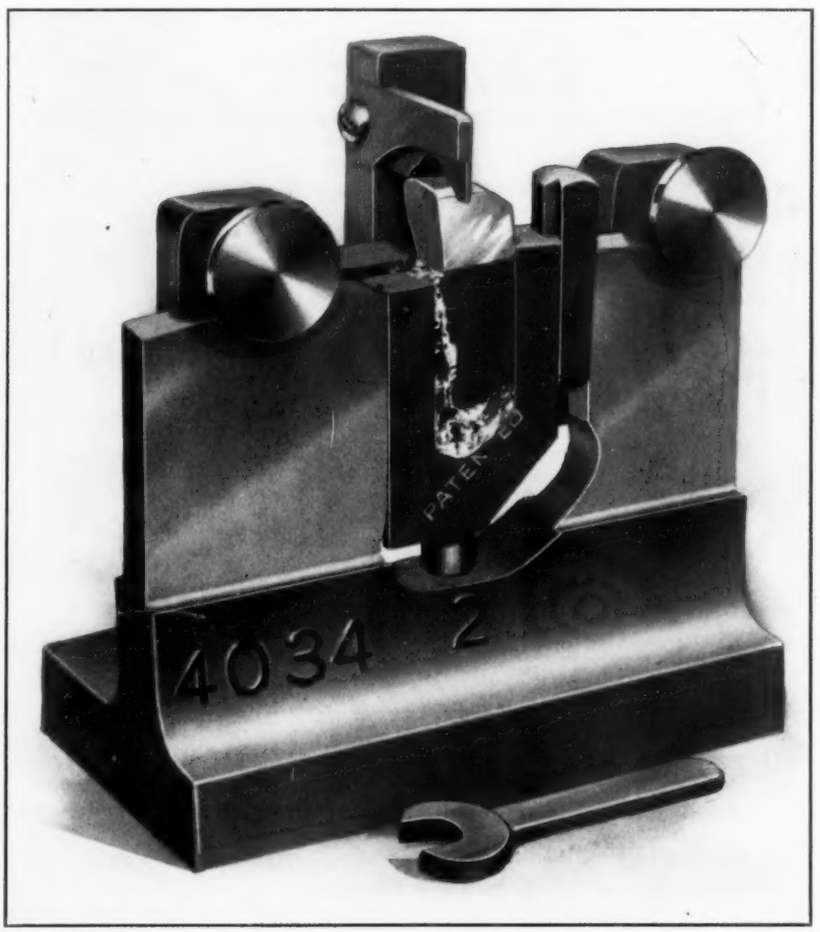


FIG. 3. TOOTH SETTING GAGE.

Utility of Standard Measures.

I was once a draftsman in a government office, and it fell to my lot to detail an instrument, a part of a submarine mine, so that we could have it manufactured and keep its construction secret. This instrument was composed of steel, brass, rubber, etc., and had perhaps fifteen or twenty parts to it. Each piece was of a certain size and certain shape—remember that. Each piece was detailed on a separate sheet and all sizes were written on the details. Those fifteen or twenty sheets went to nearly as many manufacturers, and in due time all the pieces came to the office, to be assembled. There was no trimming necessary to make those pieces go together; they fitted as tho one man had done it all.—*Woodworker.*

In an emery wheel rotating at high speed the maximum stress theoretically is on the circumference of the hole at the center and experiments bear this out, the cracks beginning at the center and spreading outwards.

The New Taylor-Newbold Metal-Cutting Saw.

EDITORIAL CORRESPONDENCE.

On May 25, I, along with the representatives of several other mechanical papers, was invited by the Tabor Manufacturing Company, of Philadelphia, to see some tests of the new high-speed metal cutting Taylor-Newbold saw. It is probably as well that I *saw* the tests, for had a mere statement of the accomplishments of this saw been handed me, I would have found it hard to believe.

The first exhibit was a 9¼-inch cold saw mounted on the spindle of a No. 5 Brown & Sharpe milling machine. This saw was started at a speed of 76 revolutions per minute, and cut through a piece of 1¾-inch hexagon cold-rolled steel in 26 seconds; it was then speeded up to 96 revolutions per minute, when it cut through in 22 seconds —the travel of the table was a little over 8 inches per minute. We then went to the drawing office where Mr. Newbold showed us the broken tool, Fig. 1. This tool was cutting 1.88 carbon steel 12 inches thick, taking .04 *inch feed per cutter*, and had been broken by the work slipping while the saw was advancing through the work at the rate of 40 inches per hour. Fig. 2 shows two chips welded together. These chips were made by the same saw which carried the broken tool, while it was running dry; the two chips after leaving the saw touched and welded together at point of contact.

Mr. Newbold then explained the construction of the tool and tool holder seen in position in the setting jig, Fig. 3. The channel in the outside of holder next the cutting edge fits a projection on the saw blade; the wedge being driven in at the back of the holder secures the holder in the saw blade. There are two half-round grooves running lengthways in the tool holder (see Fig. 1) one at the front and one at the back of the tool shank, the shank of the tool is similarly grooved at front and at rear; the tool, after being tempered by the Taylor-White method, is held in position in the tool-holder, and an alloy of zink is poured into the aperture between the tool and the tool holder; the complete tool and tool holder is then ready for grinding and adjusting, which is done in the adjusting jig, Fig. 3.

In the afternoon we went out to the Tioga Forge Company's shop, where they had a 36-inch saw mounted on the spindle of a heavy Newton cold-sawing machine. The blade of this saw, Fig. 4, is 7-16 inch thick; the inserted teeth of high-speed steel are thirty in number; fifteen of them are ½ inch wide, the remaining fifteen are 5/8 inch wide. A narrow cutter and a wide cutter inserted in the blade alternately. The cutting edges of the narrow teeth are about 1-16 inch in advance of the cutting edges of the wide teeth. The saw was started in at a cutting speed of 85 feet per minute to cut the end off a .35 carbon steel connecting rod, measuring 14 inches in depth by 8¾ inches in thickness (in direction of traverse). It went through this piece in 20 minutes. The saw itself showed no signs of distress, but the machine upon which it was mounted was apparently strained to its limit. I don't want anyone to think for one moment that I am casting any reflections upon that Newton cold-sawing machine. It was built to run ordinary cold saws, and the foreman of the Tioga Forge Company assured me it was turning out from eight to ten times the quantity of work it was built to handle. After the connecting rod was removed from the work table, a small marine engine crosshead was clamped, and the ends cut off. The diameter of these ends, one of which is shown full size in the half-tone Fig. 5, is 4½ inches, and it was cut off in less than 4 minutes. The saw that did these quick cuts had been running on steel of from .25 to .45 carbon for *130 hours without regrinding*.

Mr. Platt, foreman for the Tioga Forge Company, showed us some single-throw .40 carbon cranks in which the saw cuts measured 5 by 5½ inches, two cuts to each crank, or 18 cuts in all, the total time setting and sawing 2 hours and 25 minutes, actual cutting time 80 minutes; the best previous time on this job with an ordinary cold saw was 12 hours and the saw of no further use. It will no doubt be noticed that I have said little of the performance of the ordinary cold saw. An ordinary cold saw after two cuts through 9x12-inch .35 carbon steel has to be sharpened; if one tooth breaks in the work, the rest are almost sure to be ruined. When I recall that pile of worn-out saws in the corner of the Tioga Forge Company's shop and that other heap outside the shop door, I think the less said the better.

The Tabor Manufacturing Company is about to place the Taylor-Newbold saws on the market and will make them in sizes from 4 inches diameter by 5-32 thick to 84 inches diameter by 1⅛ inches thick; the 84-inch saw will weigh about a ton. They manufacture them under exclusive rights to the Taylor-White process for the cutters, and to the thorough treatment given under this process is to be attributed the wonderful success of the saw.

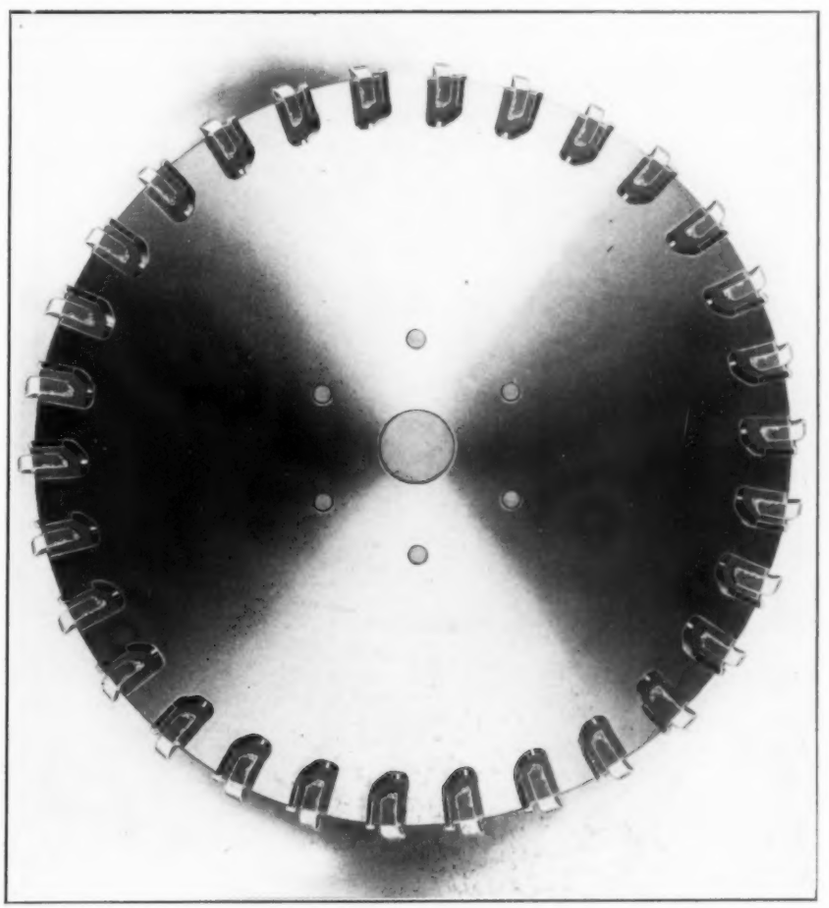


FIG. 4. 36-INCH SAW THAT DID THE WORK.

With these saws the operator has nothing to do with either the grinding or setting of the cutters in the tool holder. When the cutters become dull, the wedge is driven out and the cutter holder and cutter come out in one piece. The cutters are then sent to the grinder who grinds them, and with the setting jig adjusts them by means of the set-screw at the bottom of the cutter holder to the correct hight.

It will be seen at Fig. 3 that the small piece just above the edge of the cutter has

a large curve with a smaller one cutting into the center of it; the large curve is for the wide cutters and the small one for the narrow ones, thus setting the narrow cutters in advance of the wide ones.

The operator has a duplicate set of cutters already ground and set, with which he replaces the ones being ground, merely driving in the wedge and seeing that the set-screw abuts upon the bottom of the recess in the saw blade.

Mr. Newbold states that the time necessary to insert these thirty cutters is ten minutes. I am, however, inclined to doubt this statement, for when I started to check the time he took to insert one cutter, he was finished with the job before I had time to get my watch out.

The saws are fool-proof as far as the inserting of the cutters is concerned, there being only one way in which the cutter can be put in.

The life of these cutters is of course dependent upon the amount and hardness of the stock removed by them. There is in a new cutter sufficient stock left for about ½ inch of grinding, and one grinding will remove only about .010 inch; that allows for fifty grindings, and taking the working life of one grinding at 130 hours it gives us over two years working ten hours a day, exclusive of holidays, as the life of a set of cutters. At a cost of $1.25 each (the cost of renewal) the maintenance per ten-hour day on thirty cutters amounts to the magnificent sum of *6 cents*. In these blatant times this saw may well be cited as an example of superlative modesty. For four years it has been saying nothing and sawing wood—I mean steel—at Bethlehem. And the blades that have been doing this are not played out yet. Fig. 6 shows some Taylor-Newbold sawdust full size. E. A. S.

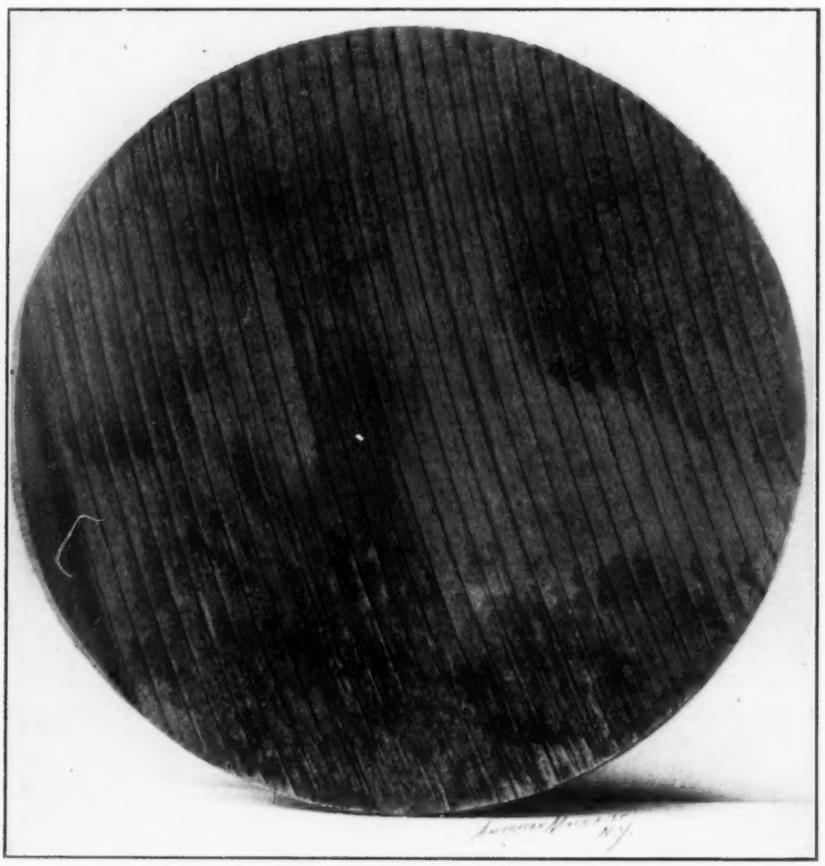


FIG. 5. END CUT OFF OF ENGINE CROSSHEAD.

Foreign Markets for American Machinery.

With the employment of Chinese labor in the mines practical people are beginning to hope that the mining industry in South Africa will rapidly develop. During last year Britain sent £359,052 worth of mining machinery to that market, £590,260 worth of locomotives, £322,000 worth of steam engines, £674,000 worth of miscellaneous tools and machinery, making with other machinery "lines," a total value of considerably over two million pounds sterling, or nearly £400,000 over the trade in 1902. There is a revival in the demand for mining and excavating tools, while some good orders were given out last year for locomotives—a Glasgow firm (Neilson, Reid & Co.) obtaining the most substantial part of the trade. Holders of galvanized iron for fencing purposes should experience a brisk demand from the managers of South African mining companies for the construction of "compounds" for Chinese laborers. British exporters are exceedingly wroth at the action of the South African shipping monopoly. Only last week a leading authority on this subject stated that "the present hold which American manufacturers exercise in South African markets is largely the result of the low freight rates which prevailed for many years subsequent to 1890. It was greatly by virtue of these rates that American goods were

FIG. 6. TAYLOR-NEWBOLD SAWDUST.

able to take the place of British manufactures. Broadly speaking, it is true that for some time, and even now to a certain extent, British merchants are subject to a heavy differential rate as compared with American competitors. For some time ships sailing from New York to South Africa, which were controlled by the Shipping Ring referred to above were carrying American freight at 10 shillings per ton, as compared with the freights of 25 to 50 shillings per ton which the British shipper had to pay. Again and again was I assured by merchants in South Africa that they had filled up their order books with American goods, simply because the freightage from the United Kingdom prohibited trade with the old country." This is the British side of the case, but it is certain that excessively cheap freights have enormously benefited United States machinery trade with South Africa, and it is necessary that arrangements should be made to give you a continuance of cheap ocean transport. Your manufacturers are now pressing the South African railroads to arrange with them a system of through rates from the United States, but the railroads have not yet consented, recognizing that it would be a severe blow to British trade, altho there is every probability that the request will be granted in the future. You have largely made your trade by cheap transport to the South African market, and it is essential that your machinery exporters should carefully safeguard their position and retain this vital advantage.

Makers of electrical plant and accessories will find the Argentine market well worth attention. Numerous companies hitherto using horse traction have decided to adopt electrical power. Horses are very cheap in Argentina, but yet it is found that electrical traction is cheaper. Some of these companies have as many as 30,000

horses, so anyone can understand how great the saving would be in actual expense once the electric installation has been effected. Therefore the tendency is all towards such a movement and as a result there is an increasing demand in the Argentine market for all sorts of articles connected with the plant. There is at present a class of machinery which is in increasing demand, too, in the Republic, such as is used in refrigerating establishments, dairies, the baling and cutting of alfalfa. There is also a chance for people interested in mining for placing really good class machinery for almost any of the higher grade metals in which the Andes abound. The Argentine Government has just instructed its official engineer (Don Pablo Nogués) to purchase abroad certain boring machinery and has set aside $50,000 (United States currency) for the purchase of such machinery he may report as being the most suitable. I may add that there is a good deal of grumbling among importers at the way American goods are packed, a matter which it would be advisable to attend to in the future. As the annual trade in iron and iron manufactures to Argentina amounts to 26½ million dollars (gold) it is worth looking after.

I referred on a recent occasion to the complaints made by British manufacturers of sugar-making machinery that the West Indian planters—altho receiving the benefit of the abolition of sugar bounties, for which British taxpayers have to pay—do not reciprocate by placing their orders for plant in England, but give their orders for such machinery to United States makers. One planter, writing from Demerara, states that American machinery has been imported into the West Indies not only because the United States has been taking the bulk of the sugar produced there, but also for the important reason that lighter, better and more finished mills and other labor-saving appliances have been found to exist in the United States than in the United Kingdom. F. C. C.

London.

A new alloy for anti-friction service is mentioned in the *Elektrotechnischer Anzeiger*, of Berlin. It consists of copper intersected with particles of graphite. A plate sprinkled with graphite is dipped into a copper bath when the copper is deposited on the plate and encloses the graphite. The plate is then withdrawn and again treated with graphite, after which it is reinserted in the bath, and the two operations are alternately repeated until the required diameter is reached. It is said that the friction on metal so treated releases the particles of graphite, which then acts as a lubricant.

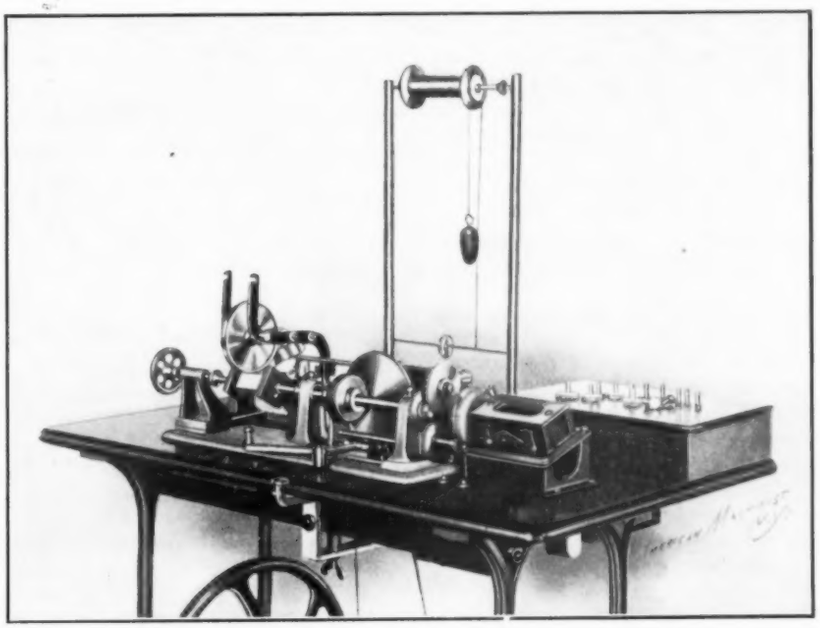
The sterilization of water by heat is the most perfect of all known methods, as it is thereby practicable to destroy with certainty every species of micro-organism.

A Bobbin Winding Machine.

BY ALFRED GRADENWITZ.

Bobbins such as used in connection with any description of low-tension electrical machinery, as telephones, bells, measuring instruments, etc., as well as those for arc lamps, are mostly wound by hand, the empty bobbin being rotated in a lathe or similar machine, while the insulated wire is moved to and fro by hand. Such winding is of course never correct, it being necessary to insert a strip of paper beneath the outermost layer of wire, and to wind the outer layer with special care, in order to give the completed coil a neat appearance. Moreover, this hand winding is liable to be rather loose, resulting in large dimensions of the coil.

Endeavors have been made for some time past to replace this process by a mechanical method, but the results so far obtained have hardly been satisfactory, the crossing of two wires resulting in the danger of short circuits and the cut off of several layers of wire being a most frequent occurrence. The automatic bobbin winding machine illustrated herewith was designed by the firm of Conrad Felsing, Jun., Cöpenick, near Berlin, with the object of obviating all these drawbacks and to enable bobbins to be wound without any defect. As a matter of course, accurate material is indispensable with a precision machine—that is to say, the bobbins have to be wound with the greatest care, and the insulation of the wire should be uniform and the wire have a constant diameter throughout.



A BOBBIN WINDING MACHINE.

The machine consists of a frame for the driving mechanism, with either a fixed or a friction pulley for mechanical drive, or with foot-power. This frame is fitted with a table upon which is mounted the mechanism proper.

The wire is wound off the feeding spool, which is retarded by means of a weighted brake; the wire runs vertically as far as a guiding pulley, whence it is led through the winding mechanism to the magnet coil which is being wound. The latter is located centrally on a shaft by means of two cones, this shaft being driven by a friction disk, various speeds being thus available for different thicknesses of wire. On the other side of this shaft is arranged a revolution counting mechanism. The winding mechanism, as patented in all the civilized countries, consists of the following parts: A spindle provided with a fine thread, where a nut attached to the so-called laying carriage is moved to and fro. The laying carriage consists of a bow where different guiding pulleys are arranged, and which may be lowered on to the coils to be wound. In addition, there has been mounted in this bow a pressure pulley, the pressure of which may be increased by a weight inserted above. This is, however used only for winding relatively strong wires.

Below this pressure pulley there is a special guiding device consisting of two tongues of metal maintaining the tension of the wire and guiding it to the bobbin. The laying mechanism is reversed by means of a clutch in connection with a conical wheel; the clutch is pressed into the conical wheel by means of a spring which is electrically tripped when the laying carriage reaches either end of its travel. This machine is built with from one to four heads; a skilled operator can take care of four of these heads.

At Buffington, Ind, the Illinois Steel Company has erected steel towers 200 feet high on each bank of the Calumet river, which is a navigable stream, for carrying an electric power cable to its new cement plant.

Chips in the Cupola.

Some time ago Mr. Osborne started in our columns an inquiry as to the practicability and profit of melting gray-iron chips in the foundry cupola. As many of our readers have been interested in the matter we take pleasure in reproducing here an article upon this topic which has been prepared for *The Foundry* by A. E. Outerbridge, Jr., of Philadelphia. The article is as follows:

While I have had considerable experience during more than twenty years in this matter, I am not prepared to write an article of a favorable nature, neither do I wish wholly to condemn the practise. In former years it was customary for quite a number of foundries to cast each day several pots from over iron, molded by apprentices, in which borings were packed. These pots were then charged as scrap and gave little trouble. It was found, however, that the cost of the pots exceeded the supposed gain in melting the turnings and the practise was given up. About 1872 the late Geo. Whitney, of the firm of A. Whitney & Sons, car-wheel manufacturers of Philadelphia, obtained a patent for melting cast-iron turnings in wooden boxes, he having found by experiments that the boxes (made of hemlock) were very much cheaper than the cast-iron pots and, contrary to the general expectation at the time, showed no tendency to consume when charged into a cupola, even toward the end of a heat when the entire mass of iron and fuel was incandescent, on account of the fact that carbonic acid gas is always present in the upper zone and prevents combustion of the inflammable wood until the burden descends to the melting point which is but a short distance above the tuyeres. By that time the contents of the box are in a plastic state and ready to melt. The wood, which has become charred, then burns, adding its quota to the fuel.

This process was used continuously in the foundry of A. Whitney & Sons during many years while I was with them, in fact I believe until the concern passed out of existence and the plant was demolished. The borings were car-wheel iron, obtained from boring the hubs of the wheels, and, if my recollection is correct, averaged about 5 per cent. of the melting each day. There was no appreciable loss in melting traceable to this comparatively small amount of turnings, but there was an increase in the depth of the chill of the mixture observable wherever the borings were melted. In 1887 I severed my connection with the firm of A. Whitney & Sons and accepted a position as metallurgist with William Sellers & Co., incorporated, and I introduced the Whitney process in their foundry. Before adopting the method we made many tests, even going so far as to melt 160 boxes holding about 100 pounds of borings and turnings each in a cupola without any other material except one ton of pig iron placed upon the bed.

The blast was reduced to about one-half of the usual pressure, and the metal from the spout was all cast-iron pigs. These pigs were cleaned from adhering sand, the sculls, drippings, cinder mill shot, etc., gathered up and weighed. The recovered metal weighed a little over 90 per cent. of the charged metal.

The pigs cast in sand were perfectly white and contained about ½ of 1 per cent. of silicon, tho the borings were soft iron averaging over 2 per cent. silicon.

At that time the average cost of No. 1 foundry iron at Philadelphia was about $21 per ton and of No. 2 about $20 per ton. Both grades were used in about equal proportions. The marketable value of the gray-iron chips was about $10 per ton and the cost of the boxes, including the materials and labor, $3.60 per ton of borings packed. For several years we charged all of the gray-iron chips we made in the machine shop in boxes in the cupolas.

SPECIAL MELT OF GRAY IRON TURNINGS AND BORINGS.

Date of Heat, *Sept. 9th,* 190 *3*

Size of Bars, 1″ sq., 15″ long.
Distance between Supports 12″.

WM. SELLERS & CO, INCORPORATED, per *A. E. O.* Cupola No. *1*

Test.	Breaking Strain.			Deflection.			Resilience.			Fluidity Test.	Shrinkage in Total Length.	Fractures
	A	B	Mean	A	B	Mean	A	B	Mean			
1 First of Heat	2625	2820	2723	.110″	.126″	.118″	.48.07″	.59.22″	53.64	9″ 9″	.231″ .236″	Close
2 Middle of Heat	2780	2875	2828	.118″	.127″	.122″	.54.61″	.60.70″	57.66	7⅞″ 7¾″	.220″ .228″	"
3 Last of Heat Exp.	2855	2825	2840	.119″	.113″	.116″	.56.55″	.53.14″	54.85	6¾″ 6⅞″	.225″ .226″	"

Total number of boxes charged		135
" weight of metal charged	30395	lbs.
" " " coal charged	4200	"
Pounds iron melted to 1 lb. fuel	7.21	"
Total weight of iron recovered	27797	"
Per cent. metal recovered	91.4	"

Test bars were cast as usual from beginning, middle and end of heat. Drilling taken from fractured pieces of six test bars gave 1.40% silicon.

The following castings were made of this metal:

Saddle No. 11 for 60 inch Slotter	620	lbs.
Center Post No. 10, 47 foot Turn Table	1590	"
Four Counterweights	22840	"
Test Bars and Test Castings, Scrap and Foundry Pig	2747	"
Total	27797	"

The metal from the spout was hot and fluid to the end, good gray iron with fine grain, samples cast in sand against heavy iron chill block showed ⅛ in. to ¼ in. chill on 2 in. section. No sparks were observed at the top of the chimney and not more than usual at the spout.

There was undoubtedly some increased loss in melting, tho not sufficient to be of serious consequence or even to show on the monthly records, but the roof of the foundry became covered in time with a brown stain or powder, due to the iron rust which we traced to the escape of fine particles of heated iron from the stack. Whenever a box was broken by the impact of pig iron falling upon it, as sometimes happened, allowing the chips to fall out, there was a cloud of iron particles visible at the top of the stack. Then, too, the escape of loose chips of gray iron into the cupola before reaching the melting zone caused a rapid and excessive formation of slag, due to the oxidation of the finely divided iron as it fell through the burden and was attacked by the blast. This caused an increase of back pressure and occasional blow holes were found in the castings, which were attributed to these causes. In 1892 the price of pig iron had fallen about 25 per cent., while the price of lumber and labor had increased, and I came to the conclusion that there was no longer any advantage to be gained in melting gray-iron borings in wooden boxes, and therefore discontinued it. In the late boom period when the price of iron had increased abnormally, I took up the question again, having now found a means of making gray-iron boxes from over pig at a low cost. The boxes with gray-iron tops weighed about 170 pounds each and held 100 pounds of borings each.

As in the former tests, we made experimental melts in the cupola, charging the packed boxes only, omitting even the ton of pig on the bed. I include herewith a copy of one of our statements, showing the result of melting 135 boxes of turnings without any other material and also a section cut from test bar *B* from the first of the heat, which gave a good strength record—that is, 2,820 pounds transverse breaking strain on a bar one inch square section, with supports 12 inches apart.

Note: The section referred to shows a close grain, such as would be expected from good gray iron intended for machinery castings.—Editor.

The tensile strength was about ten times the transverse strength, or 28,000 pounds per square inch. Several good castings were made from this metal. The metal was fine grained, dense, and of a light color, tho it was not hard. The cost of making the gray-iron box was much less than the cost of making a wooden box, but as we did not make sufficient over iron to cast all the boxes required it was necessary to melt some iron for this purpose, which of course increased the expense

somewhat. At present I am not using any gray-iron borings, and do not expect to resume the practise unless the price of pig iron soars upward once more.

From a metallurgical point of view, the melting of gray-iron borings, either in wooden or gray-iron boxes, or pressed into briquettes with a binder such as pitch or other suitable carbonaceous material (as I have done experimentally) is open to criticism, in my judgment. To be successful it is necessary to insure perfect protection of all the chips in their passage from the charging door to the melting zone, and this is exceedingly difficult to accomplish. One broken box in a heat will cause much damage to the fluid metal, and for this reason I am not an enthusiastic advocate of melting gray-iron borings with pig iron in a cupola for any purpose except sash weights, counter weights or other castings of a like nature, where hidden flaws do not injure the casting.

A One Horse Power Horse.

I have no differential clutch
And no pneumatic tire;
I guess I don't amount to much,
For none come to admire
My form or speed—I have no cam;
And, to my deep remorse,
I must confess I only am
A one-horse-power horse!

They used to stroke my sorrel side
And tell how I could go,
To-day they speak in tones of pride
Of some bright red tonneau.
But, tho my sorrow is so great,
And anger is so keen,
I'm glad to have a chance to state
I don't eat gasoline.

I don't know how to carburet,
Nor how to radiate—
When I wished to get up and get
I simply struck my gait.
'Tis true, in casting out the beam
For fairness I should try—
But 'lectric, gasoline or steam,
The "mote" is in my eye!

I have no wondrous steering gear—
But still they rush to see
A thing that has, I'm pained to hear,
A horseless pedigree.
They used to pet me all the time,
But now they only shrug
Their shoulders, and pass by, for I'm
A poor old sparkless plug!

—*Unknown Exchange.*

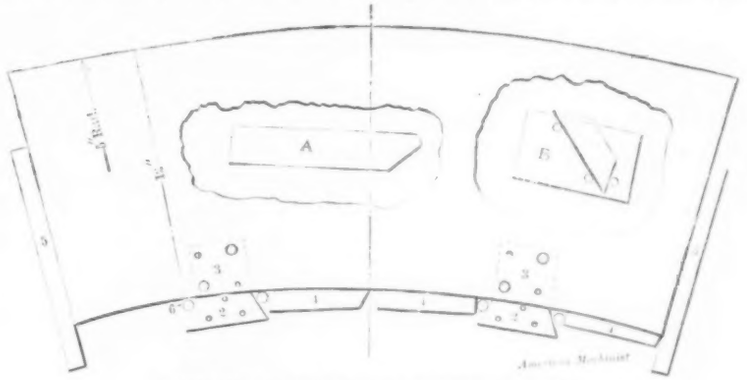
In Upper Egypt wages are from 9 to 11 cents per day; in Lower Egypt, 13 to 18 cents. Board is never furnished. Payments may be made according to the work done, when such prices as these rule: To plow 1¼ acres, 94 cents; to irrigate it, 70 cents. *Consular Reports* remarks: "On the whole, the position of the laborer in Egypt is not good."

Letters From Practical Men.

Making an Armature Segment Templet.

Editor American Machinist:

In making a die for an armature segment the first thing to do is to make an accurate templet. The sketch shows a templet 48 inches inside radius, 60 inches outside radius; twelve and one-half of them complete a circle. It is obvious that the spacing of the dovetails must be exact to insure proper piling. The usual method is to lay out the entire templet and then file to the lines as closely as possible. When greater accuracy is required three templets are made and filed until they break joints correctly. By the method here illustrated one templet is all that is required, and it can be made practically correct.



MAKING AN ARMATURE SEGMENT TEMPLET.

Take a piece of mild sheet steel of suitable thickness and turn the body on the inner and outer edges (or, if the radius is too large for the boring mill, plane it on an open-side planer with a segment-planing attachment), cut to exact length and angle. The punch, stripper and templet may all be clamped or bolted together and bored or planed at one operation; the stripper, of course, requires an additional easing.

Make the dovetail pieces 3 and attach as shown, approximately near the right positions. Leave the body holes for the screws large enough to allow for rapping to position. Dovetails for the punch can be made at the same time. Three pins in vise jaws or angle plate, as at *B*, will insure duplication of angles when grinding to finish.

Next make two test bars 4, leaving them a little long to start with. Place two round pieces of equal diameter in the angle of the dovetail for measuring points. Clamp parallels 5 along each end of the templet (a surface plate is the best place to set up) and rap the dovetails to position. In reducing the test bars to the right length care must be taken that they are exactly *the same length*. It is a good plan to dowel them together for this purpose. Rap the dovetails until the test bars placed end to end exactly fill the center space, and a single bar exactly fills the end space, then securely dowel, and the templet will be complete. If the templet is not to be used for laying off the casting to mill or plane the dovetail slots, the usual allowance of 1-64 inch may be taken off each end and the punch and die made to fit.

This method has proved quicker and more accurate than duplicate templets, and insures an accurate inside radius that is impossible on a cut-out templet.

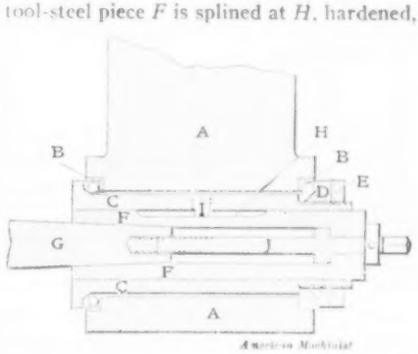
A. B. C.

An Outboard Center for the Milling Machine.

Editor American Machinist:

The illustration shows an outboard bearing for milling machine. This bearing, I think, would obviate the trouble from "cutting," so annoying in the usual male and female outboard centers.

A is the end of the overhanging arm bored through and counterbored at both ends to receive the tool-steel ball-bearing cups *B B*. *C* is a tool-steel sleeve tempered and ground on the tapered ball race at the front end, and having a parallel hole its entire length; this hole is ground and lapped. At the rear end of *C* are the adjusting cone *D* and the jam-nut *E*. The tool-steel piece *F* is splined at *H*, hardened,



AN OUTBOARD CENTER FOR MILLING MACHINE.

ground and lapped to a sliding fit for *C*. The front end of *F* is taper bored and ground to the same taper as the ends of the milling-machine arbor *G*. The screw *I*, threaded in *C* and with its point in spline *H*, prevents *F* from revolving in *C* but allows end movement to the extent of the length of spline. The shouldered screw *J*, with its end threaded to fit threaded end

of arbor *G*, serves to draw arbor *G* into *F*. In action *C*, *F* and *G* are practically one piece, revolving in ball bearings at *B*; but, owing to *F* being made a sliding fit for *C*, any expansion or contraction of the arbor is taken care of at this point. When changing or taking out arbor, the shoulder screw *J* is used to eject *G* from *F*.

DIXIE.

Grinding Boring Bar Cutters.

Editor American Machinist:

Mr. Knouss's fixture for this job, as shown at page 692, may work all right, but it looks to me as tho the clearance on one lip would be in the wrong direction, if the fixture is built and operated as he says it is. When I first looked at his drawings, and before reading his description, I supposed that after grinding one lip the cutter was removed from the fixture, turned over, and the other lip then ground, his stop *c* insuring that both lips would be the same hight. I think his device would work better if the base of it, instead of being a right angle, as he shows it, were less than a right angle by the amount of clearance desired.

WALTER GRIBBEN.

A Multiple Side-Punching Die.

Editor American Machinist:

At page 419 is shown a multiple punching die. I send herewith sketches of another multiple side-punching die. This die I will admit costs more to make, but it will last as long as the press it is used in, having all parts adjustable or with means to take up the wear.

Fig. 1 is a plan showing the slides and punches all drawn back. The movement in this die is produced by a helix or screw about 3-inch pitch, this depending upon the stroke of the press and the distance the slides are required to travel. This screw is held in the ram of the press and works in a brass nut with pinion teeth on the outside meshing into teeth cut on the periphery of the oscillating ring. The punching slides are connected to the ring by six links, this reducing the friction, as the cutting is done when the links approach the line of the slide, acting in the manner of a toggle joint. On the down stroke of the press the helix is driven down through the "nut," giving about one-third of a turn to the pinion and turning the oscillating ring to which the slides are connected by the six links, bringing the links on a line with the slides and punching the six holes. On the up stroke the movement is of course reversed, withdrawing the punches, as shown, far enough for the punched shell to be easily removed.

Fig. 2 is a part sectional view showing the helix *A* in the nut *B*, the pinion teeth meshing into the teeth on the oscillating ring. The slides, machine steel, are dovetailed with an angle of 10 degrees, the outside bearing of each being adjusted by a flat gib and two set-screws, the inside bearing having a triangular block *F* held down by the studs and nut *D*, the stud having a hole tapped in it for the adjusting screw E. These pieces *F* are made by turning a gray-iron ring the size of the hole in the oscillating ring, leaving the hole as large as possible to get a long bearing for the slides, the ring is then drilled for the six studs and transferred into the die bolster, drilled and tapped. The studs are then screwed in and the ring is drawn down tight by the six nuts; the bearing for the slides is then milled in the same manner as A. C. R. describes, excepting that a 10-degree cutter is used instead of a straight one.

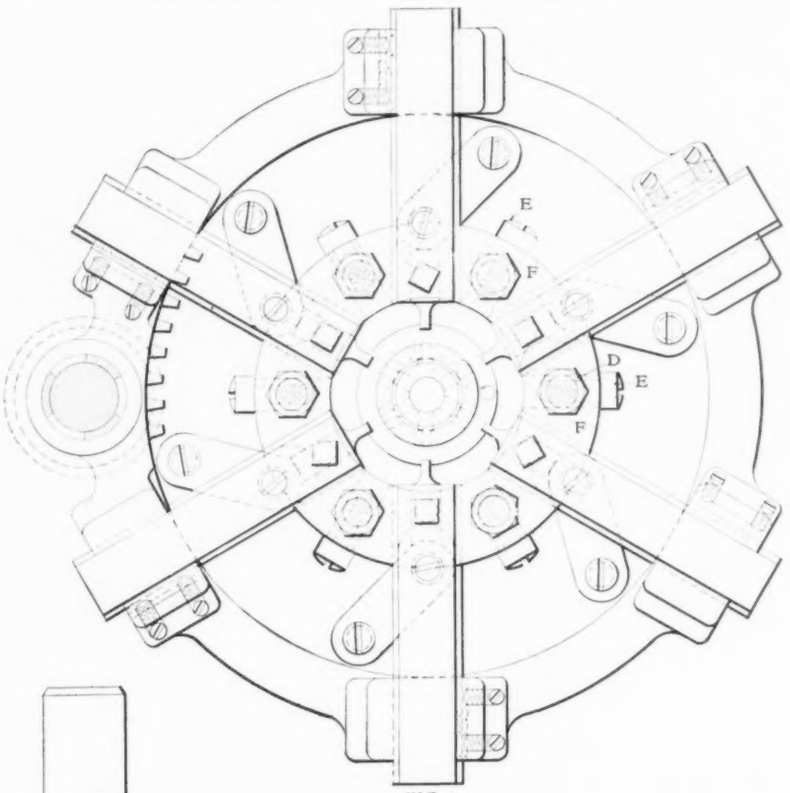


FIG. 1

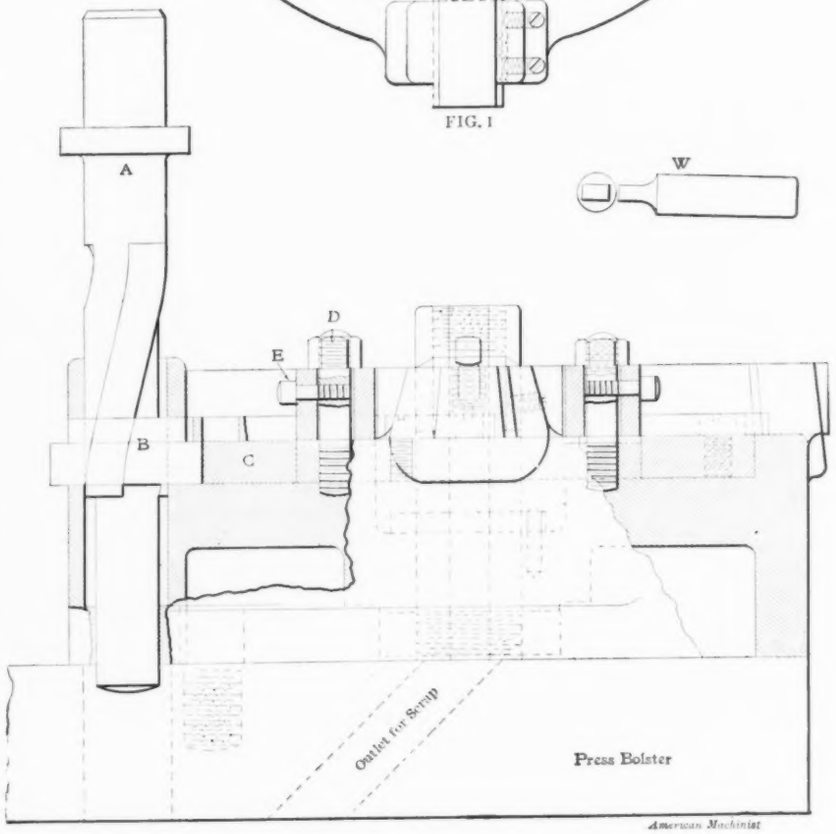


FIG. 2.

A MULTIPLE SIDE PUNCHING DIE.

In the die described by A. C. R. the slides and their punches are each made in one piece; this is radically wrong, for it means that when a new punch is wanted, a new slide is necessary. In the die here

shown each punch is made from drill rod and held in the slide by a set-screw.

One of the punches is shown at *W*, and in Fig. 3 is shown the die-holder with a section of the dies and the retaining ring *G*. The holder is made from gray iron, providing the stock to be punched is not very heavy. Six dovetailed slots are milled in the die-holder for the dies. The stock for them is planed in one piece, cut off the proper length and fitted into the slots; the holder is then put on an arbor and the ends are beveled off as shown at *H*, and the machine steel ring *G* is screwed down tight upon the dies. The outside diameter is turned, allowing a few thousandths of an inch over the size of the shell for grinding; the die is then spaced off in the miller and worked out to the proper size. The retaining ring *G* is taken off, the dies are removed, hardened and tempered and then assembling the die and fitting the punches before the dies are ground to the size of the shell, leaving the grinding for the last operation, you have a sharp cutting edge to begin with. A mistake that a great many diemakers make

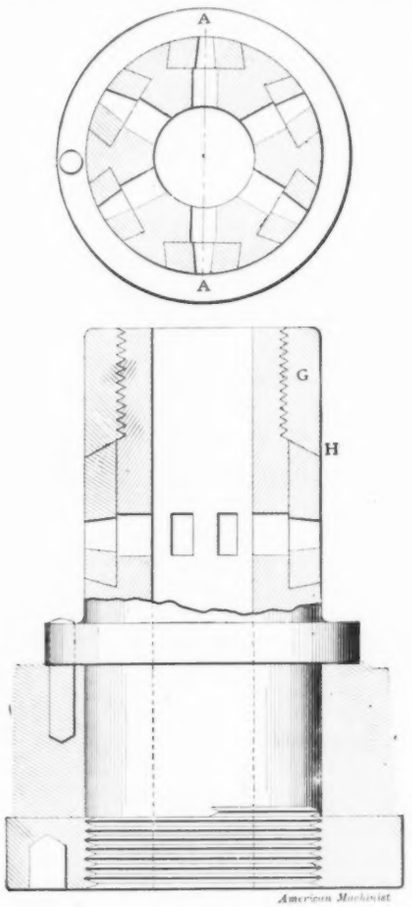


FIG. 3. DETAILS OF DIE.

is in fitting a punch; it is sure to take the edge off, no matter how careful one may be, and then it is necessary to regrind to get a clean cut.

This die, to some men, will look very expensive; but I wish to say to them that if they used a milling machine instead of a hammer and chisel in making a die of this kind, or a die of any other kind, they would get better results.

JACK MAKS.

A Rig for Turning Crank-Pins.

Editor American Machinist:

As it has been some time since matter has appeared in your columns relative to crank turning, the following is submitted

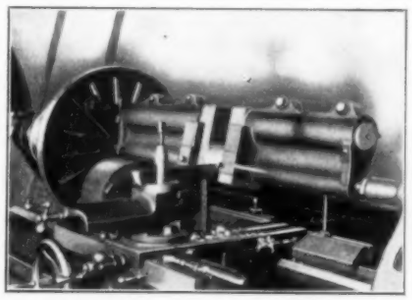


FIG. 1. A RIG FOR TURNING CRANK-PINS.

in the hope that it may be of interest to some of your readers.

Fig. 1 shows a rig for holding the crank while the crank-pin is being turned. It will be seen to consist of a sleeve embracing the entire length of the shaft, and provided with the clamping screws seen at the top of the cut. The small set-screws shown on the face of the crank arms provide a simple and effective means of adjusting alinement of centers, and also to relieve the thrust.

Fig. 2 shows the completed crankshaft, which, as is seen, is of reduced section from about the middle of its length—the rig being bored to fit both diameters.

I may mention that the device, as used in the shops of the American Well & Prospecting Company, has proven to be entirely satisfactory, and extremely rigid.

H. FREY.

Fifty Years in American Shops.

Editor American Machinist:

I have been apprentice, journeyman, foreman, superintendent and general manager in some of the largest iron works at present in successful operation. My first experience in a machine shop was in 1850 as an apprentice in Wilmington, Del. Wilmington was a city then of about 18,000 inhabitants and had several large machine shops, Harlan & Hollingsworth's being the largest. This firm was established about 1820; in 1850 they were building steamboats, rolling mills, paper mills, grist mills and passenger cars, employing about 1,500 men. Pusey & Jones was the next largest firm in the same line, employing about 1,000 men. J. Morton Poole & Co. had only a machine shop manufacturing paper machinery. In addition to the shops named there were a number of small machine shops doing a jobbing trade. In these shops lathes, planers, boring mills, post and column drill presses, slotting machines, shapers and bolt cutters then were the leading tools. The lathes above 24 inches swing had about all the attachments the present-day lathe has. Small lathes from 22 inches down had no feed screw or compound rest. The feed was through a rod driven by a belt from the spindle; the carriage in some lathes was moved by an endless chain. Planers as a rule had only one head on the cross-rail; if there were two both heads were on the same screw and feed rod. Boring mills both vertical and horizontal were built on the same lines as the planers. Slotting machines as a rule were the same tool as built at the present day; the same can be said of the drill press. The tools of fifty years ago were all light, and very little improvement was made in them until up to about the year 1880. There was only one vertical boring mill in Wilmington; it was a 12-foot mill in the shop of J. Morton Poole & Co., their own make. The work now done on a boring mill was then done in a lathe. There were no milling machines, no gear cutters, no radial drills, no turret lathes, no grinding machines, nor hundreds of small tools the modern machine shop has at the present day. The machine-tool trade was confined to the New England States.

J. Morton Poole & Co. made paper machinery. Mechanics acquainted with paper

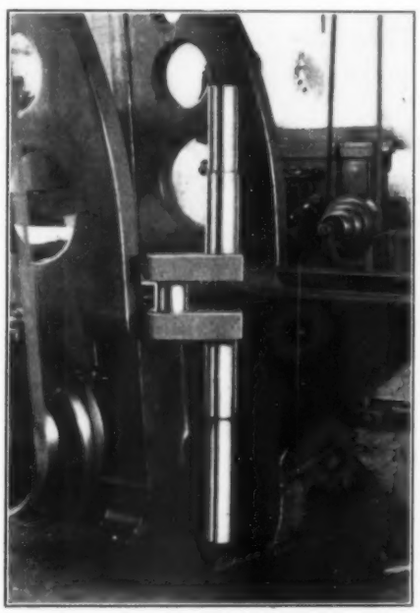


FIG. 2. THE FINISHED CRANK.

machinery know the rolls must be ground so close that when placed together they must hold water. Rolls from all over the State came to Poole's shop to be ground. About that time Mr. Black, of Black & Clawson, was building paper machinery, but he did not know how to grind the rolls. He came to Wilmington and went into Mr. Poole's shop as a workman to learn that branch, worked there for six months and went home to his own shop master of the business.

I don't want the reader to think that

all the A1 machinists were in Wilmington. Eighteen hundred and fifty-eight found me working at William Sellers & Co.'s, Philadelphia. This was a tool shop exclusively, and ranked at the head of tool builders of this country. At that early date I found the Sellers shop equipped with the tools you find in most of the machine shops of the present day, with very few exceptions. A boy was put through the Sellers shop about the same as he was in the shop in Wilmington. He had to learn all the branches and serve five years. It was the same in all Eastern shops. After working for Sellers a short time I changed to Bement & Dougherty, another high-grade tool shop. While I was at Bement's the Franklin Institute had an exhibition of mechanical appliances in Philadelphia, and among the tools exhibited was a radial drill from some Eastern shop. The gentleman having it in charge was explaining it to Mr. Bement and asked his opinion. Mr. Bement answered by saying, "It would do to bore punkins." At that time I was working in the drawing room. This "punkin" drill gave Mr. Bement an idea. He ordered drawings made for a large radial drill with about an 8-foot arm and to take in under the arm 8 feet. Of course we all had to go and see the "punkin" drill. The drill I speak of was built and set up in the shop, and when I was last in Bement's shop, about eight years ago, the drill was still in use. It was the pioneer of the radial business. The Bement & Dougherty shop was equipped with a good stock of New England tools and several large tools of their own build. Among the latter were a planer, 10x10 feet, that would plane 60 feet long, and a lathe about 84 inches swing. On this lathe the large cast-iron screw was turned for the first elevator put in the Continental Hotel, Philadelphia. It was made in sections of about 12 feet and 40 inches in diameter, and was operated by a pair of reversing engines. It was the first passenger elevator erected in Philadelphia. The pitch of the screw was about 30 inches—all finished and put in place by Bement & Dougherty, and was a masterpiece. This shop, like Sellers', had mechanics who had learned all the branches. The I. P. Means shop was on the Delaware River, and is at present a part of the Cramp works. The shop was established in 1828—seventy-six years ago. Merrick & Sons was established about the same time, now known as the Southwark Foundry, and a number of others I could name, all high-grade manufacturers of all lines of machinery.

The spring of 1885 I moved to Hamilton, Ohio, taking the position of superintendent of the Niles Tool Works. I was a stranger to all except Mr. Alexander Gordon, the president, whom I had known for a number of years. I found the Niles shop quite small as compared with the shops of Sellers and Bement, working about 250 men—Mr. Gordon, president, and Mr. R. C. McKinney, treasurer and manager. The only order was to increase the business and turn out the work second to none. I set to work, with the force I found, to organize the departments and enlarge the works. The machine department was made into gangs—one for fitting up boring mills, one for lathes, and so on until all the lines of tools were covered, making in all about ten gangs. These gangs were made up with boys and men, ranging in number from five to twenty. The same system was carried out all over the shop until the entire machine shop labor was on piece work, with very few exceptions, and all accomplished to the entire satisfaction of men and employer. I found in this shop men fully competent for leaders, men who had learned their trade in England, Canada, Germany, and a few that had served their time in the Niles Works. We had at that time a general foreman who was also the inspector, and put every tool under the belt before it left the shop. In addition to the general foreman, we had one lathe and one planer foreman. I left the employ of the Niles Tool Works January 1, 1893, for another position. The force had increased up to 1,200 men. I visit the Niles whenever I am in Hamilton, and find the same men, almost to a man, in the positions I left them and the same system in force.

I close this letter by telling you something that was said to me by a very prominent manufacturer. He employed me a short time ago to come into his shop and stand around and see what I thought was wrong and report to him. I spent several very pleasant months with him. Among the items I reported was about the work he was turning out on a Jones & Lamson turret machine. All machinists know what class of work this machine will make if handled by a skilled man. The machine costs about $1,200, set up. A very nice young man, about twenty-two, was running this machine. He kept himself and the machine very neat and clean; it could have been in a lady's parlor. The work this nice young man was turning out was about 10 per cent. of the capacity of the machine. When I brought this to the notice of the president of the company, he looked up at me and said, "Joe, what do you expect from a street car conductor?"

JOSEPH H. SPRINGER, SR.

Wanted: A Method of Marking Negatives.

Editor American Machinist:

I have never seen in your paper any information on the subject of marking negatives. By this I do not mean a system of indexing them, but some process for rapidly and neatly lettering them with a title and such other descriptive information as is desirable.

In our work we use the camera quite extensively in showing up our goods, and find it desirable to have our various offices supplied with photographs of different products and to have these photographs so lettered that it does not require someone to explain each picture in turn as in going over a family album.

We have had recourse to lettering backwards on the films with "opaque," but even if it were easy to do on the thin and transparent negatives, we are obliged when we have dense negatives to letter them backwards as before and then cut these letters through the film in order to get a letter that will contrast with the rest of the plate.

This lettering backwards is slow work and is apt to be poorly done. One thing we tried, which was highly recommended, was a set of rubber type, with the letters reversed, of course, to bring them right on the prints. This plan proved a failure because the type was small and soft and because it presented the same difficulty once more, that of being obliged to scratch out the letters on thick negatives.

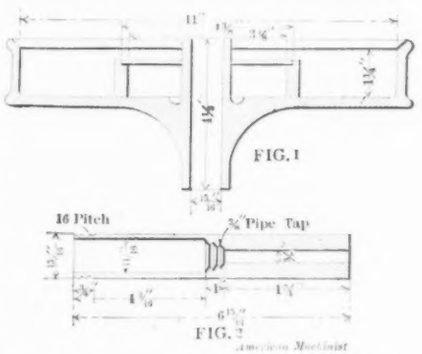
We have thought of other schemes which have failed for one reason or another, and this letter is written in the hope that someone of your readers has succeeded in helping himself out of such a difficulty and will be willing to share the secret.

Davenport, Iowa. W. E. MOREY.

Work Done on the Flat Turret Lathe.

Editor American Machinist:

The sketches show examples of work that I am doing on a Jones & Lamson flat turret lathe. The time taken to finish these pieces is considered very good by



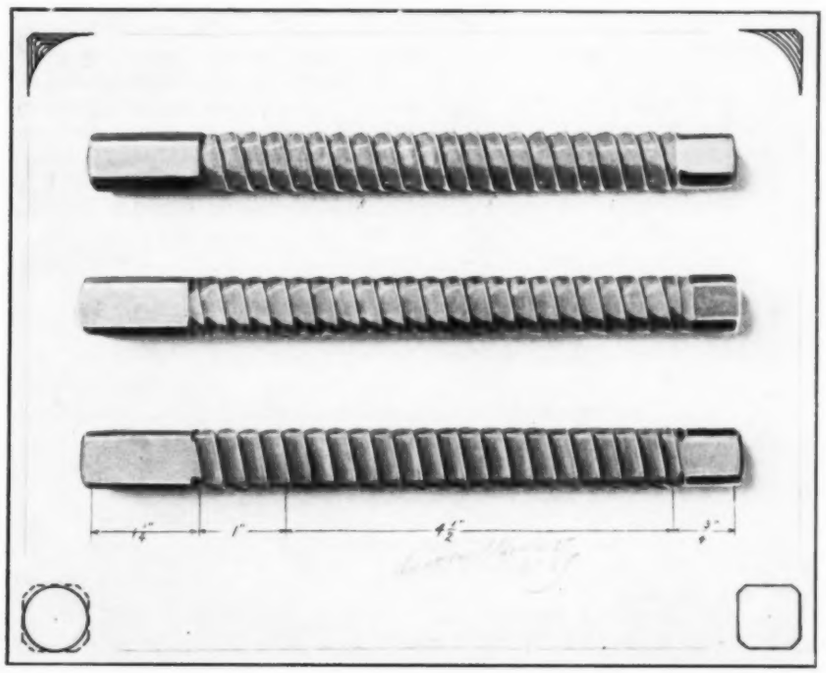
WORK DONE ON THE FLAT TURRET LATHE.

those who have seen them. Fig. 1 is a cast-iron frame for an alternating-current ceiling fan armature; this frame is held in a 12-inch four-jaw chuck; it is bored and finished to the sizes shown within a limit of .0015 in 22 minutes. Fig. 2 is the shaft for this armature frame; it is made from the bar of 1-inch high-grade machine steel, drilled, turned and threaded, but not tapped, in lots of 100 in 11 minutes. I use this machine on a great many chucking jobs also on shafts for motors, etc., and consider it to be one of the most profitable tools in the machine shop. F. H. B.

An Interesting Set of Broaches.

Editor American Machinist:

We have just completed an order that included in its parts the making of 2,600 holes, like the sketch in the lower right-hand corner of the photograph. This job was looked upon with considerable apprehension, as our experience with broaches had been a close approach to failure. This was confidently predicted to be in the same class, when the drawings came into the shop for broaches substantially as here shown. The variation from standard practise consists, as will be seen, in threading the pieces with a coarse ratchet thread in a lathe in place of milling the teeth; and, what seems of greater import, of producing a taper on the corners in circular form instead of on the square portion. I have endeavored to show in the upper left-hand corner of the photograph the cutting action of a standard broach, and in the opposite upper corner that of this form of broach. As will be seen, the first is a series of connected straight cuts, increasing in length as the large end of the broach is approached, while the latter consists of constantly decreasing arcs toward the finishing cuts. The broaches were made up in sets of three, as shown, and the lineal dimensions of the lower or finishing one apply to all.



AN INTERESTING SET OF BROACHES.

The stock was first milled square on centers, the two upper broaches being milled a little under finish size, and the lower one to exact size. They were then turned to the following dimensions: First broach—¾ inch length, .656 inch; 4½ inches tapering, .656 to .729 inch; 1 inch straight, .729 inch diameter. Second broach—¾ inch length, .727 inch; 4½ inches tapering, .727 to .800 inch; 1 inch straight, .800 inch diameter. Third broach —¾ inch length, .798 inch; 4½ inches tapering, .798 to .875 inch; 1 inch straight, .875 inch diameter. The pieces to be broached were drilled with a 21-32 inch drill, allowing the small end of the first broach to enter easily. The 1¼-inch portion of each broach was made enough smaller to drop through the hole left by the cutting part. The finished hole is 11-16 inch across flats and ⅞ inch over corners.

After turning, the broaches were threaded two per inch double, then filed across flats to correspond with the threaded portion. Through a misunderstanding, the small end of the first broach has been ground flat—affecting it only for illustration purposes, however. The broaches shown in the photograph have made over 1,000 holes and are in working shape yet.

H.

A Discouraging Incident.

Editor American Machinist:

I would like to ask your opinion about a thing that happened some few years ago in a foundry not a hundred miles from Troy, N. Y. In the foundry they made a specialty of valves and also did a little jobbing when it came along. As they had no pattern for extra heavy valves, the patternmaker had to build on to the regular pattern. Sometimes it would take him half a day to do this, or more if the pattern had not been lagged before. Once there came in an order for two valves and the boss machinist told the foundry foreman to make four, as they had orders coming in every now and then and it would save the time lagging up the pattern. Well, there were four made; two were sent away and two went into stock. A few days after this the manager saw these two, called the foundry foreman and said, "What are those valves made for?" The foreman told him that when the pattern was in the sand he thought it was best to make a couple over, as they were wanted every little while. "Well, don't make any more than are ordered next time."

It must be remembered that this pattern was in the sand as a regular nearly all the time. In a little while those two were sold and an order came for six more. The machinist boss said, "You might make eight or ten of them." "Oh, no," the foundry foreman said, "I do not want to get myself into a racket about it. I was told not to make more than were ordered." The machinist boss said: "Why, you see how much time is lost having to put that lagging on the pattern, and, another thing, you could hide them so that the manager could not see them." Well, the foundry foreman thought that it was all right to save the time and money for the company, so he made eight and hid the other two away where he thought the manager would not get on to them. But he did, and he called the foreman and said, "Didn't I tell you not to make any of those extra heavy valves over the number that were ordered?" The foreman apologized and told him about the time and expense it took to alter the pattern; but it was no use, he would not be satisfied with any explanation, and said "they might lie there for seven years before any more are wanted, and I will put it down in your order book so that you can see it every day." And this is what he put down, "After this date make no extra heavy valves unless by order from office."

Well, about this time the patternmaker was making some new patterns for extra heavy valves; the manager went away for a time and the patterns were ready before he came back, but no order was put in the book and none went into the foundry, so of course there were no patterns made off those new patterns. When the manager came back he was jumping mad because there were no castings made. He called the foreman and said, "Why is it that you did not make some castings from those new extra heavy valve patterns?"

"Because I did not get any orders?"

"That is not what I asked you," the manager said.

"Well, what did you say, then?" asked the foreman.

"I asked you," said the manager, "what was the reason that you did not make them?"

The foreman was getting hot under the collar then, and answered him rather sharply, "I told you that I did not get any orders to make any."

"Well," said the manager, "if that is the way you want to get out of it, you can get out of it altogether in a month from this date."

So he did. Now, who was right and who was wrong? About this time the manager was going into business for him-

self, and I don't know whether this had anything to do with firing the foreman. He had been with them several years and had given good satisfaction up to this time, as far as I know.

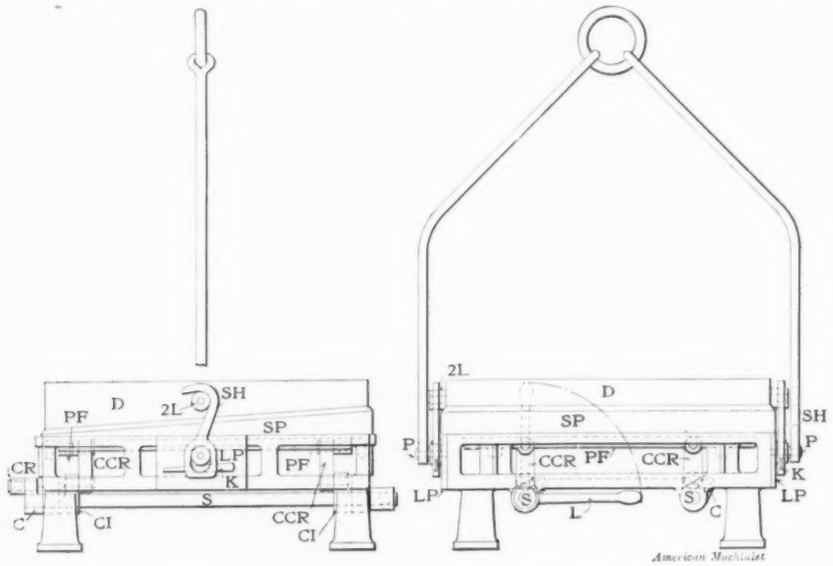
THOS. WATHEY.

Cleveland, Ohio.

Inverting a Molding Machine.

Editor American Machinist:

Experience in molding the drag for the frame casting of a mowing machine, using a molding machine of the type here shown, proved that when the mold was turned over some of the long and slender projections of sand would almost invariably break off unless nailed or gaggered thoroughly. This nailing and gaggering was a great nuisance generally and made the molding almost twice as expensive for the drag as for the cope, which was molded on a somewhat similar machine. I noticed that in molding by hand this trouble did not occur, because the drag was not turned over after the pattern was drawn, and in hand molding nails and gaggers were unnecessary.



ARRANGEMENT FOR INVERTING A MOLDING MACHINE.

The molding machine is of the stripping plate type, in which the metal half-pattern, which is not shown here, rests on and is fastened to the pattern frame *P F*, which is lowered or drawn by throwing the lever *L* to the dotted line position. This lever is keyed to one of the two shafts *S S* which are connected by the two cranks *C C* and a connecting rod *C R*. Four cranks *C I* are keyed to these shafts and these raise or lower the pattern frame *P F* by the four gray-iron connections *C C R* when the lever *L* is moved. When the parts are in the positions shown, the half-pattern projects through the stripper plate *S P*. The drag *D* is put on the stripper plate, as shown, and rammed up. Before I designed the inverting arrangement the practise had been to place the bail pins *P* in the lugs of the drag and lift it off after the lever *L* had been thrown to the dotted line position, thus drawing the pattern. The drag was then turned over and lowered to the floor. It was this turning over that made nails and gaggers necessary to prevent weak sand projections from breaking off. The new arrangement consisted of two gray-iron lug plates *L P*, which were bolted to the sides of the machine and the two swinging hooks *S H* with their keys *K*. By the new method the flask, having been rammed up, the hooks *S H* were swung into place as shown over the flask lugs *Q L* and the keys *K* driven tight enough to hold the flask firmly to the machine. The bail pins *P* were then placed in the plate lugs, as shown, and the machine with the drag was lifted by the air lift and turned over and lowered to the floor on top of the drag. The pattern was then drawn with the lever *L*, the hooks *S H* loosened and swung away and the machine lifted off, turned back and returned to its working position for another drag. The extra weight of the machine, making in all, as nearly as I remember, about 1,800 pounds, made a large air lift necessary, and a 10-inch cylinder was used. The machine had originally large coil springs counterbalancing the weight of the pattern frame *P F* and the pattern, which was several hundred pounds. The new method made it necessary to reverse the arrangement of these springs so as to assist instead of resisting in drawing the pattern with the lever *L*. The new arrangement made a large saving in labor cost and a gratifying increase in the output of castings.

S. A. WORCESTER.

Ink for Patent Office Drawings.

Editor American Machinist:

Referring to the letter by Mr. W. R. Mittendorf, at page 630, I would say that, while I do not wish to take the position of advocating any brand of ink, I feel compelled to take up a cudgel in my own defense. I have seen the message from the Patent Office that he speaks of, "Lines pale and rough; admitted for examination only." I will say that I have never had one of my drawings turned down by the Patent Office, no matter what kind of ink I used. I have also made over many drawings that other men have had refused by the office.

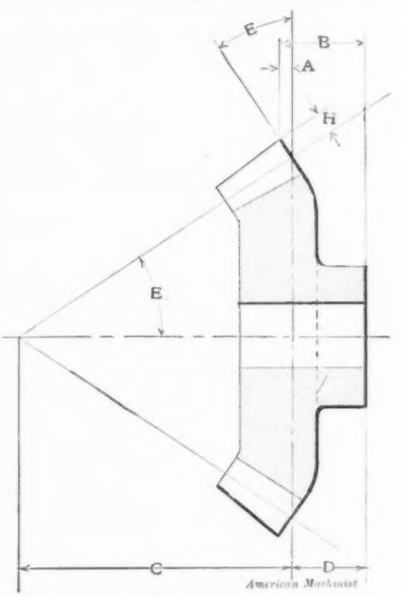
It is my opinion that the trouble lies in the fact that the drawing is greasy and dirty before the ink is put on it. Whenever I get a spot of dust or soot on a drawing, I immediately erase it and put my work into the hands of the attorney clean. These lawyers and inventors do not take the care of drawings that draftsmen do, and it is from them that I have experienced most of my difficulty with sweaty and dirty hands. I have tried gasoline for the final cleaning, but with indifferent results, and now use a soft rubber. If the ink is not rubbed off in cleaning the drawings, and the scratcher is kept safely in the draftsman's tool box, drawings will not be refused by the Patent Office on account of lines being "pale and rough."

R. P. KING.

Dimensions for Cast Bevel Gears

Editor American Machinist:

The sketch shown by Mr. Robert Bruce at page 548, giving the necessary dimensions for cut bevel gears, recalls the fact that for cast bevels we have frequently had drawings returned from the shop to have dimensions *A* and *B* placed thereon. It was our usual practise to give *C* and *D* in addition to the other dimensions required in the construction of the pattern, but the machine-shop foreman always called for *A* and *B* also, as he claimed that the proper way to set cast bevels for finishing was to measure from the point of the tooth, the pitch line not being visible.



NECESSARY DIMENSIONS FOR CAST BEVEL GEARS.

We also tried cutting the pitch line upon the pattern in such a way that it would show on the casting, but the method given above seemed to be preferred. The distance *A* is, of course, equal to *H* multiplied by the sine of *E*. GERALD E. FLANAGAN.

Building a Well From the Top.

Editor American Machinist:

Fig. 1 shows a well in section that was built in sandy soil where to build in the ordinary way was out of the question. This well was 25 feet in diameter and 25 feet deep It was built above ground and lowered into place. At the start a shoe was built of the cross-section as shown in Fig. 2, and then the excavation was made as deep as the nature of the ground would allow. The shoe was then placed and the well bricked up 2 or 3 feet higher than the ground level. A stiff leg and boom was rigged with hoisting engine so that the boom would swing well out of the way and over the well. The excavation was carried on evenly around the shoe so that the wall would settle evenly. As the well went down, the wall was bricked up and, using an endless course,

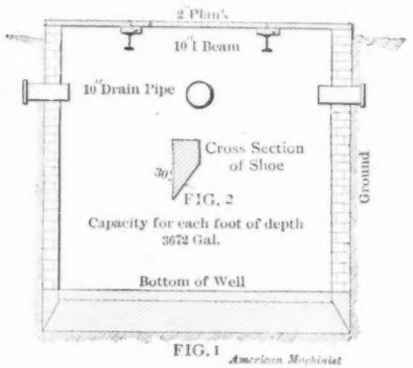


FIG. 1 *American Machinist*

BUILDING A WELL FROM THE TOP.

no cutting of brick was required. This was gradually run out at about 2 feet from the top and a double row of headers made a good finish. Soft brick was used to allow the water from the ground to get in and they were laid in Portland cement. At the proper level drain tile were set in the wall for pipes, etc., obviating the cutting of holes.

The cover was made of 2-inch plank built in sections so it could be easily handled, and was carried on I-beams. In such a well it is advisable to set a couple of pieces of rail in about half way up so a platform can be built on them if necessary at any time after the well has been completed. If any further details are wanted, I shall be pleased to furnish them.

G. F. M.

[It is common practise in Germany to build wells from the top down, in certain kinds of soil. The Germans, however, do not use a shoe.—Ed.]

The engineer of a power plant at Racine, Wis., has been compelled to enclose the big whistle in a wire netting to keep the sparrows from nesting in and muffling it.

Pig Iron Warrants, Long Contracts and Strikes.

The following is from an address by George H. Hull, president of the American Pig Iron Storage Warrant Company, delivered at the convention of the American Foundrymen's Association, Indianapolis, June 7:

The proposed letting of a contract for a large amount of castings to be used in connection with the Pennsylvania tunnels in New York, deliverable over a period of four years, has for several months been a topic of much discussion among iron foundrymen, and the would-be contractors have found embarrassment over the question of how to protect themselves in making a bid at a fixed price and for fixed dates of delivery over so long a period in face of the well-known irregularities which in the United States attend the supply of pig iron, both as to price and deliveries. With the experience of the last five years fresh in mind, during which iron advanced to $25 per ton, and the stock held by all the merchant furnaces was on two occasions reduced to less than 50,000 tons, the idea of making a contract for 300,000 tons of castings, with fixed dates of delivery, seemed like tempting fate. If, for example, the furnaceman with whom the foundryman has made his contract for pig iron should for any reason beyond his control be unable to make or deliver the iron at dates specified, and iron shoul ' again be scarce and high, it is impossible to tell how serious the result might be.

The custom prevalent among foundrymen in the United States of taking contracts for castings, deliverable on fixed dates, over long periods and at fixed prices, and of relying for their materials upon a contract with iron producers which contains a clause reading as follows: "Shipments and deliveries subject to strikes, accidents, deficient transportation and all other causes beyond our control," seems to the mind of the Scotch foundryman to voluntarily invite disaster. The possibility of a strike in his own works he recognizes as a risk of his own, and one which he cannot avoid, but the idea of doing business on the basis of assuming everybody else's risk all down the line, he does not comprehend.

If the foundryman allows the strike or accident clause to be inserted in his contract for pig iron ordinary prudence would prompt him to require it in his contract for castings, and so much each one all along the chain of producers and consumers; anyone who omitted to do so would take a double risk; under such a custom everybody becomes relieved of the necessity of making deliveries on time, through either his or anyone else's embarrassments, and as soon as this becomes general a labor leader in any one branch of the industries may control all the productive industries of the country. A steamship in process of building, for instance, would progress towards completion only when labor in all the trades which furnished any material for that steamship graciously permitted it to do so. Labor leaders already have power enough without such aid from employers. It is fortunately often impossible for the labor leaders in one trade to induce other trades to join in a sympathetic strike, but just to the extent that employers accept this strike or accident clause they hand themselves over "bound hand and foot" to the mercies of labor leaders of every trade which is in any way connected with their own.

But this is not the only evil encouraged by this strike or accident clause. It is probably the most potent means which could possibly be devised for discouraging the accumulation of reserve stocks of raw materials. If the sellers of pig iron, for instance, were not permitted to embody this strike or accident clause in their contracts—that is, if the consumer would accept only contracts for iron which required positive delivery at times specified—then the sellers, through ordinary prudence, would be forced to carry a reserve stock sufficient to enable them to make deliveries through any ordinary period of interruption which might take place in their works; and these reserve stocks if thus accumulated in every branch of manufacture would not only be a great boon to all the constructive industries of the country, but they would go far towards discouraging labor strikes within these industries. The Hon. Carroll D. Wright, United States Commissioner of Labor, when he visited New York in the winter of 1903 as the representative of President Roosevelt to investigate the anthracite coal strike, said to an enthusiastic exponent of the reserve stock system that if the operators in the United States had carried out this gentleman's theory of accumulating large reserve stocks of coal there would probably have been no strike. Whether to strike or not to strike usually depends upon the visible chances of success. In whatever branch of production the strike is contemplated success depends largely upon the reserve supply of the product immediately involved. If the stock be small, the necessities of the community go a long way towards forcing the producers to resume work, even to the point of conceding to unreasonable labor demands. On the other hand, if the stock is large, that one fact will almost certainly prevent a strike, unless it is founded on some good and sufficient reason.

In this country, under the existing conditions, the only way a foundryman can make a contract for a large amount of castings, deliverable over a long period, and be sure of having the required amount of pig iron when he needs it, is to buy it out and out and pile it in his yard at the time he makes the contract. But this would tie up an unreasonable amount of capital and occupy too much of the consumer's yard space. The producer, on the other hand, has no incentive to pile iron; he may contract his anticipated product for months ahead, deliver it on these con-

tracts as made, and if anything beyond his control prevents his producing it, he is relieved from delivery by the strike or accident clause. He may sell his expected output a year ahead if he chooses and not be obliged to carry a single ton of stock. What is the result? No one carries any stock which he can avoid, and when each period of prosperity returns to the country the whole fabric of business is hampered, delayed and disorganized by the famine in iron; prices soar to fabulous hights; all other materials follow in sympathy; laborers strike all the way up to get their share of the good times, and afterwards all the way down to ward off their share of the bad times. Eight times within the last eighty years this country has suffered from an iron famine. Everyone who had work which required iron was behind, and the whole business of the country was delayed in consequence of the scarcity of this one article.

If the consumers of this country are in the future to be protected as to their supply of iron they must protect themselves as is done in Scotland. They cannot expect the producers to do it for them. If the producers sell them iron deliverable six or twelve months ahead, they must either protect themselves by storing the iron or demand a contract with the accident and strike clause. No prudent furnaceman would do otherwise; and yet to continue this custom is to insure a continuance of the known evils of the past.

A contract with a strike or accident clause is worse than no contract at all. It is a promise with an "if." When the "if" is not called up you could do as well without the contract as with it. When the "if" is called up you are left in a tight place, with no one under obligation to help you out. Without such a contract you would probably have bought and piled up the iron to protect yourself. Of all the delusions and snares which attend the business system of this country I know of none in appearance so harmless and yet so blighting in effect.

What the foundryman in the United States most needs is a system whereby he can purchase his iron at a fixed price, and far in advance, with the certainty of obtaining it when needed without tying up his working capital and without piling up a surplus quantity of iron in his own yard. The Scotch warrant system has satisfied this same need in a perfect manner for fifty years, and it is for this reason that it has become the established system of that country.

In Scotland when a foundryman takes a contract for a large amount of work, deliverable over a long time, he goes directly to a warrant dealer and makes a contract for warrants for a corresponding amount and time of delivery; these contracts have no strike or accident clause; they are positive and must be kept, or the seller must suffer the loss entailed. A warrant dealer in Scotland will sell protection to a consumer for five years ahead just as readily as he will for six months or a year. The charge he makes for such protection is based on what it will cost him to buy iron by warrant the day he makes the contract and carry same to the date of deliveries called for by the contract. When the warrant dealer enters into a contract to protect a consumer in this manner he must necessarily buy warrants to protect himself, and as long as the contract of protection runs he must own and carry warrants to protect himself. By this system the capital and space necessary for perfect protection to the consumer are provided at a reasonable cost and without his depriving his business of either the capital or yard room required. The establishment of the warrant system was as great a relief to the iron producers and consumers of Great Britain as was the establishment of the national banking system to the financial exigencies of the United States: One created a demand for bonds which never before existed; the other created a demand for iron which had never before existed; one necessitated the carriage of bonds by every national bank; the other necessitated the carriage of iron by every warrant dealer. It is through this necessity for carrying a reserve stock as a protection that Scotland accumulates six to twelve months' supply of iron, while the United States but three to six weeks' supply.

How are the American foundrymen to bring about in this country the condition existing in Scotland? I expect Americans will have to bring it about substantially just as the Scotchmen did; that is, they will, in the beginning, have to buy and carry warrants for a moderate amount as a reserve stock, until the business of selling protective contracts becomes an established business. We have to begin with—already in existence—the American warrant. This warrant is simply a negotiable warehouse receipt, which describes the brand, quality, amount and location of the iron it represents. Warrant iron is graded either by analysis or fracture; when by analysis, it is according to the rules adopted by the American Foundrymen's Association. Each warrant is for 100 tons of 2,240 pounds, and the warrant company is responsible for the brand, grade and weight described on its face. Every warrant is registered by a trust company of high standing, and no iron can be delivered from warrant yards without the signature of the trust company and the president and secretary of the warrant company.

For fifteen years the average stock of iron carried in the United States has been less than three weeks' product. During this same period Scotland has carried more than six months' product. Think of the United States attempting to control the iron trade of the world with a stock equal to less than twenty-one days' production! The Venetians wrested the trade of the Orient from the other nations by her liberal warehousing policy. As long as history has existed, we learn that the nations which in time of plenty stored their products against the time of scarcity have drawn voluntary tribute from the other nations and augmented their commerce, while the nations which have neglected to do so have dwarfed their commerce. As the trade of the world is greater and more important to-day than ever before, so warehousing is more important to the welfare of the human race than in any past era.

The Milan Exposition.

The Milan Exposition proposed for 1905 is postponed to 1906. All applications must be made before May 31, 1905, special applications involving the erection of kiosks or special rooms must be in by February 15, and articles to be exhibited should be delivered between December 15, 1905, and February 1, 1906, while heavy machines should be not later than December 1. The several departments of the "Working Hall" are as follows: (1) Graphic Arts—Manufacture of artistic and decorated papers; (2) Artistic Manufactures of Metal and Wood; (3) Ceramics—Pottery, Glass; (4) Textile Manufactures; (5) Wall Paper, Leather, Hangings, etc.; (6) Products of Industrial Arts generally. Machines will be in operation in each department. Address Commissione della Galleria Internazionale del Lavoro per le Arti Industriali, Milano, Italy.

The following recent orders for machinery for export are mentioned by the *Journal of Commerce* (New York): Hess Machine Works, of Philadelphia, has taken German and Swedish orders for file-making machinery. The Falkenau-Sinclair Company, of Philadelphia, has recently secured a large straight-side press order from Manila, Philippine Islands. Wm. White & Co., of Moline, Ill., have secured a contract for big machinery to be installed in the Canadian plant formerly owned by the Locomotive & Machine Company, of Montreal, and now controlled by the American Locomotive Company. The Philadelphia Pneumatic Tool Company has German, French and Belgian orders in hand. The American Pulley Company, of Philadelphia, is about to make some fair-sized shipments to Australia and New Zealand. The Gardner Governor Company, of Quincy, Ill., has secured Japanese, Russian, Australian and Cuban orders for pumps.

Trackless railways are being tried in Germany, with considerable success except financially. On common earth roads the power required is much greater than on rails, and there's where the money goes. We would be glad to see some American company give it a fair trial on asphalt.

MEMBERS OF THE INSTITUTION OF MECHANICAL ENGINEERS AND OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS AND GUESTS AT THE WORKS OF THE ILLINOIS STEEL COMPANY, SOUTH CHICAGO, JUNE 1.

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Not the Fault of Patents.

Those who are fond of charging acknowledged monopoly evils to our patent system and advocating the abolition of patents or a radical reconstruction of the patent law may well contemplate a case recently brought to light in connection with telephones, the patents on which have been perhaps more bitterly attacked than any others and have probably been more influential in building up opposition to the patent system. No patents have been more strongly assailed than those upon telephones. Everyone who thinks our patent system is wrong and that our patent laws should be radically reformed or patents abolished altogether has cited the case of the telephone patents to prove his case, and it is true enough that, by sharp practise, some of the results intended to be secured by the patent laws were, in the case of the telephone patents, effectually avoided. Nevertheless, effective competition in the telephone business has sprung up in many cities, especially throughout the West, and that it is not patents but other and real monopolies that do the mischief is clearly shown by the history of the telephone operations in New York city as revealed in articles recently published by the *Evening Post*. These articles give an account of the doings of the company which controls the telephone business of the city and are "mighty interestin' readin.'" It is a record of lying, deceit, trickery and bribery, by means of which a monopoly has apparently secured a firm hold upon the business of New York. It is shown that the overhead wires were maintained in New York for many years in the face of public sentiment because the "corporation influence" was against their removal and that finally the bill providing for their removal was allowed to pass because it was at last seen that the proposed underground conduit for wires could be monopolized in such a way as to shut out competition. This was done, notwithstanding the fact that the bill providing for the construction of the conduits was ostensibly intended especially to prevent them being monopolized and to make competition always possible.

The same influence, it is charged, prevented conduits or pipe galleries being constructed in connection with the new underground railways, altho their construction would have avoided the necessity for continually digging up the streets of the city to get at and repair pipes of various kinds. It was feared that the proposed pipe galleries—demanded by every other consideration—would weaken or destroy the monopoly of the telephone company and that was sufficient to insure the defeat of the project to construct them. Several companies having abundant capital and the endorsement and support of the best citizens of New York have tried to get the use of these conduits supposed to have been constructed with that object and have failed, the result being a complete monopoly of New York's telephone service and the levying of exorbitant charges. We call attention particularly to the fact that this is a monopoly not at all based upon patents. Other cities have effectual competition in telephone service, notwithstanding patents and the monopoly is maintained here by means of a monopoly of a portion of the public highways, which monopoly has been secured and is maintained by means deserving of the severest condemnation. It must be obvious that the remedy for such outrageous abuses is not to be found in crippling the patent system, but in seeing to it that legislation, and the administration of laws, municipal and State, shall be in the interest of the people instead of in the interest of men seeking to monopolize valuable franchises.

Anent the St. Louis Exposition.

Those who have been readers of the AMERICAN MACHINIST since the days of the Chicago Fair and the Paris Exposition of 1889 will remember that we have always considered it our duty to give to our readers as accurate an idea as possible of the actual state of affairs in each exposition, so far as machinery men were specially interested in it. We have not considered it to be any part of the business of the AMERICAN MACHINIST to "write up" or to "write down" an exposition, but simply to tell the truth about it as nearly and as completely as practicable.

If this truth when published seems a criticism of the fair or of those connected with the fair, we cannot help that and are in no way responsible for it.

The fact is that a good portion of the apparent inefficiency of world's fair organizations is not to be blamed upon any individual or individuals, but is, so far as anyone can now see, inherent and inevitable. The task of building up and getting into shape any organization as large as that of a modern exposition is a tremendous one, and before it can be completed the exposition is over and the organization goes to pieces; the experience gained by members of it being usually of little use to subsequently formed, similar organizations.

We believe these world's fairs are, broadly speaking, a good thing for the development of the country. Thousands living within reaching distance of St. Louis and who have little chance of seeing or of knowing much about the things of the world outside their own little isolated communities will go there and be more or less educated by what they see. Many a worthy ambition will be awakened there, and the general intelligence will be the greater and higher for it.

The AMERICAN MACHINIST, however, represents a certain class or division of the American people, *i. e.*, those who are interested one way or another in machine shops, the products of machine shops and the men who work in and carry on machine shops. This being the case, it is obviously our duty simply to give the facts as we find them about the exposition and the experience of those who have to do with

it so far as the machinery exhibit is concerned.

It is true, as the St. Louis papers and many others have been saying since the opening day, that there is and has been since the opening more interesting things to be seen there than any one person can possibly see. But that does not meet the requirements of the case, for nearly everyone who goes to an exposition has some particular interest in a particular portion of it, and the exposition will not be satisfactory to him until that portion in which he is specially interested is entirely complete. No number or variety of miscellaneous things that do not specially interest him can take the place of the, perhaps few, things that pertain to his specialty or that he goes there especially to see.

The necessity for giving attention to other things has caused a break in our account of what is to be seen at the exposition, but we shall resume it in due course and shall endeavor to give our readers as accurate an idea as possible of actual conditions in the machinery department; those who are interested in other things will have to get information about them from other sources.

An Hour's Work in Fifteen Minutes.

Last week an advertiser stated that a machine tool made by him would do "one hour's work in fifteen minutes." This is of course all right for the purpose for which the advertisement was written, but it is not an accurate expression, and the reason why it is not accurate is worth noting. The fact is that when any machine regularly does a certain amount of work in fifteen minutes, then thereupon that quantity of work becomes fifteen-minutes' work. Any number of men who choose to do so may go on using old machines and doing the work by old methods that require an hour's time to accomplish it—they are simply spending an hour to do fifteen minutes' work. As in the case of the twist of the increase twist drill, much depends upon which end you first begin to talk about; but as soon as any machine tool does an hour's work in fifteen minutes, that moment the work ceases to be an hour's work and becomes fifteen minutes' work, and those who continue to spend an hour in doing it are behind the times in the ratio of 4 to 1.

Medals for Parsons and De Laval.

The German Engineers' Association, in session at Frankfort-on-the-Main, June 6, unanimously conferred the Grashof medal on Messrs. Parsons and De Laval, the pioneers in turbine propulsion.

At Chicago, June 8, a building known as Machinery Hall and occupied by several firms of manufacturing machinists, was destroyed by fire with an estimated loss of $400,000. Forty-five fire engines were called to the fire.

Some New Things.

DRAWN TOOL-STEEL LATHE GUIDES.

At page 1062, Vol. 25 (1902), we illustrated a patent, then recently issued, which provided for the application of steel strips to lathe beds as guides for the carriage to travel upon instead of the usual ways of gray iron integral with the bed. These strips have now been placed on the market as a regular line of manufacture for the trade. They are made of high carbon steel cold drawn in various shapes and sizes according to the size and style of lathe or other machine to which they are to be applied. They are smooth, true and bright; can be furnished to dimensions within .002 inch and to any length required. They are made by J. L. Osgood, 121-131 Erie County Bank Building, Buffalo, N. Y.

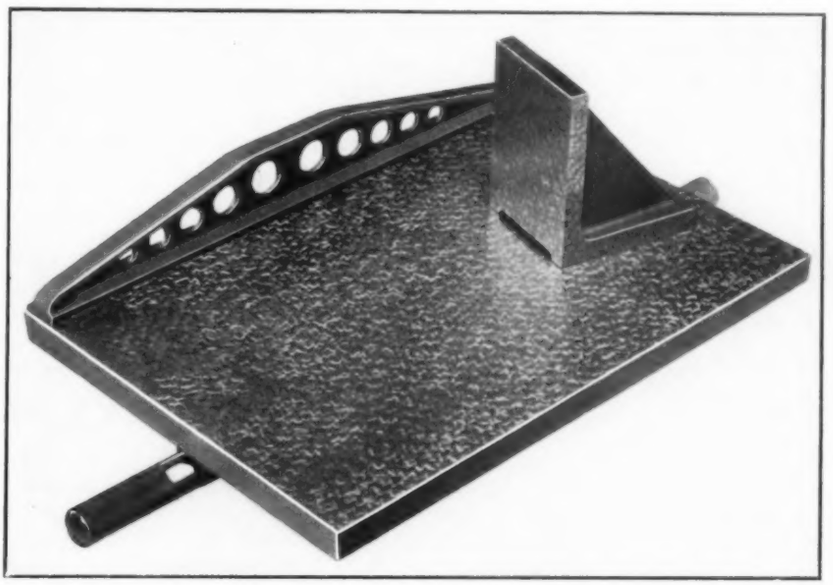


FIG. 1. HAZELTON & DONALD TESTING OUTFIT.

ACCURATE TESTING OUTFITS.

The half-tone, Fig. 1, shows a surface plate, angle plate and straight-edge as made by the Hazelton & Donald Machine Company, 612 Discount Place, Philadelphia. These are claimed to embody a number of special features contributing to the maintenance of accuracy under the different conditions of service. A common method of surface plate construction is that of an open or broken ribbing in combination with a three-point support. This of course leaves at least two corners of a rectangular plate unsupported and a consequent sag of the overhanging parts, so that however accurate a plate may be in a certain position it must change more or less when inverted. In the plate here shown the ribbing is of the deep closed rectangular type and is so proportioned as to distribute the stresses equally whichever side may be up. Fig. 2 shows the method of suspension—patent applied for—adapted for these plates by the use of which equal and self-adjusting support is provided for all the four corners and the middle of the plate. The lower frame rests upon the three points *A*, *B* and *C*, while the surface plate to be supported rests upon the five numbered points, the piece *D* resting upon a single point of the lower frame. It will be seen that in this way the weight is equally distributed and there is no possibility of distortion. The plates are claimed to be scraped to a degree of perfection that will satisfy the most exacting tests. A complete set comprises the plate, a knee or angle plate and a straight-edge, as shown, and also four setting-up blocks to be used where it is desired to set pieces for testing clear of the surface plate. The knurled grips or handles also are furnished to facilitate handling and the entire set is placed in a hardwood case.

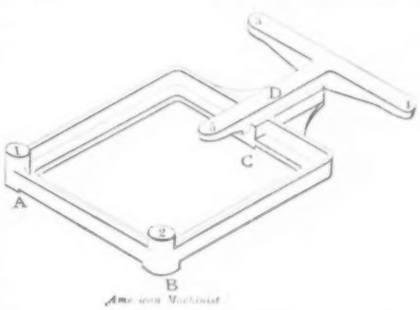


FIG. 2. FIVE POINT EQUALIZING SUPPORT.

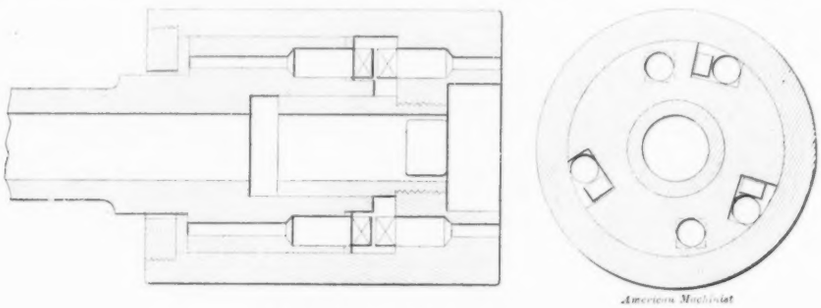
THE GLADSTONE-LALANDE BATTERY.

This is a new battery manufactured by the Battery Supplies Company, Newark, N. J., an improvement on the original Lalande battery. The negative electrode is a plate of agglomerated oxide of copper carried in a U-shaped hanger, the free ends of which are threaded for clamping nuts. The other details provide that when the battery needs to be recharged, the exhausted oxide of copper plate can be easily changed. The positive electrode consists of two flat plates, an alloy of zinc

and mercury suspended from the cover. The electrolyte is a 20-per-cent. solution of caustic soda with a layer of mineral oil poured on the top to prevent evaporation and creeping. The Western Electric Company, 259 South Clinton street, Chicago, is the distributing agent.

A NEW AUTOMATIC DIE-HOLDER.

The illustrations show a new hollow shank automatic die-holder. The forward drive is accomplished by a positive clutch, but on the reverse, when the die is rotating rapidly and must be stopped, it is held by a friction clutch. Its action is noiseless, and it reverses without shock. The friction grip consists of three rollers resting on a small incline, and embraced by a steel sleeve. All the parts subject to wear are hardened and ground. This die-holder is made by the Garvin Machine Company, Spring and Varick streets, New York.



A NEW AUTOMATIC DIE-HOLDER.

PRESS CLUTCH WITH AUTOMATIC SAFETY STOP.

It is not generally known to the uninitiated that punch presses are responsible for more maimed hands than probably all other tools put together. The carelessness of the operator in not taking his foot off the foot lever soon enough results in the press taking a second stroke just when the operator has his hands between the punch and die.

A press equipped with the device here described cannot possibly take more than one stroke with one depression of the foot lever unless the operator previously takes care to make it do so.

The clutch, Fig. 1, is simple in construction and positive in action. The press can be made to take one stroke or a series of strokes at will.

The construction is as follows: The foot lever connects with the vertically sliding bar *B*, in which there is a rectangular notch *C*. This notch engages with the cam *A* pivoted on the rod *E*, and is held in contact with it by the spring *H*. When the foot lever is depressed it carries with it the sliding bar *B*; the cam *A* and the rod *E* releasing the dog *F* which, engaging with the flywheel, turns in the direction

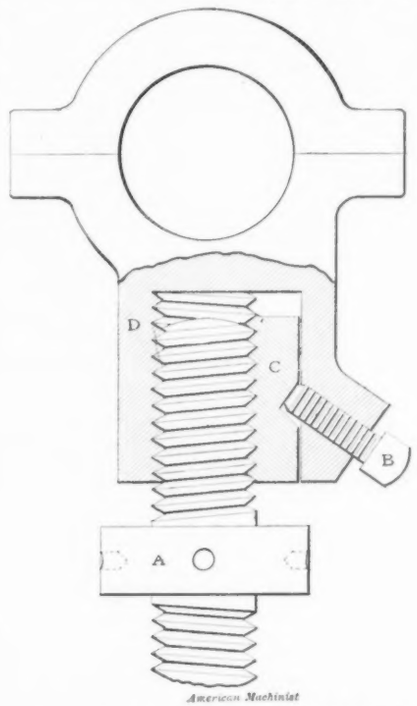


FIG. 2. PRESS CLUTCH WITH AUTOMATIC SAFETY STOP.

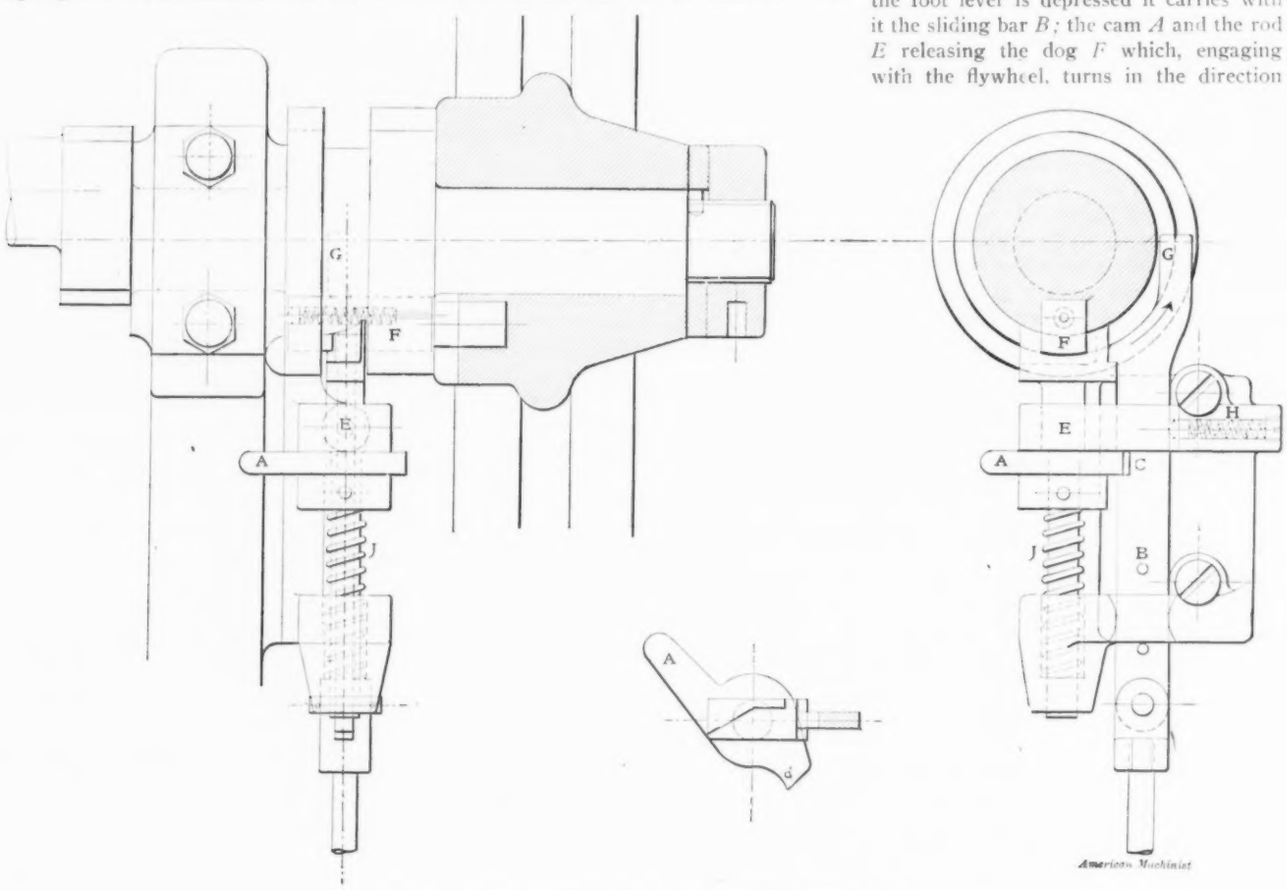


FIG. 1. PRESS CLUTCH WITH AUTOMATIC SAFETY STOP.

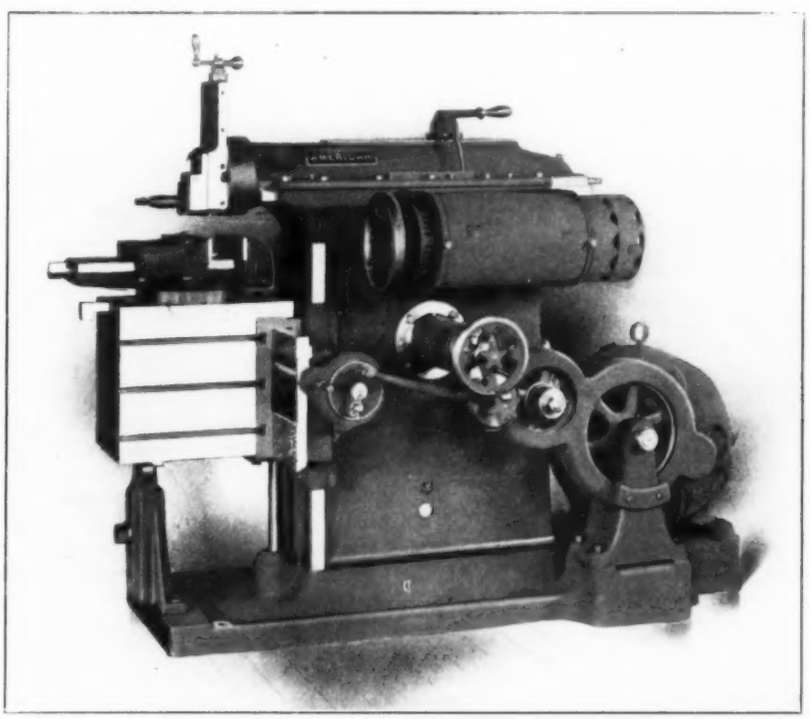
of the arrow till it strikes the sliding bar *B* at *G*, pushing the bar *B* back until the notch *C* is out of engagement with the cam *A*, when the spring *J* returns the rod *E* to position to trip the dog *F* when the press has completed its stroke.

To obtain continuous operation of the press the cam *A* is revolved upon the rod *E* until the projection *d* is in engagement with the rectangular notch *C*.

In the connecting-rod sleeve for punch press, Fig. 2, the right- and left-hand stud *A* is firmly clamped and seated against the sleeve *D* in the direction of the thrust by the threaded shoe *C* which is forced against the stud *A* by the set-screw *B*, thus taking up all lost motion. Both of these devices are manufactured and applied to presses of their make by the W. H. Hibbard Manufacturing Company, Brooklyn, N. Y.

18-INCH AMERICAN TOOL WORKS MOTOR-DRIVEN SHAPER.

In the 18-inch motor-driven shaper shown in the half-tone, a 5 horse-power



18-INCH AMERICAN TOOL WORKS MOTOR-DRIVEN SHAPER.

Crocker-Wheeler motor is mounted on a substantial base cast in one piece with the base of the shaper. The motor is connected with the shaper through gearing, and it occupies space not available for any other purpose. The controller is located at the side of the shaper, as shown, conveniently for the operator. This shaper is built by the American Tool Works Company, Cincinnati, Ohio.

A "biggest" spruce tree has been found in God's Valley, Oregon. The trunk is 21 feet in diameter, and of course they are talking of cutting it down to count the rings.

Is the "Practical" Man in Danger?

BY CORNEIL RIDDERHOF.

I used to wonder, when I read of the legions of graduates the colleges are turning out, what would eventually become of that useful class of men who are not far advanced in mathematics nor versed in many of the refinements of modern mechanical engineering, but who are making themselves useful without these accomplishments and hold their positions because they are commercially successful.

Will technical graduates, stuffed brimful with engineering knowledge, gradually crowd out these men and they be relegated to the rear? To be sure, these graduates have not spent as much time among machinery as the practical men have but during their college term no efforts have been spared to so divide and arrange their studies that there has been no "lost motion" nor "back-lash" and every particle of instruction given has gone toward making them engineers of the best and most modern kind. They can figure strength of beams, of shafts, torsional and flexural; can conduct tests on strength of materials, steam boilers, engines, dynamos, motors, etc., and could completely overwhelm the practical man with a torrent of learning.

There is more mathematics used in machine design than ever before and to greater profit than it could have been applied in former times, but nevertheless there is so much needed besides mathematics that in most cases it is but a fraction of the total requisites.

The remainder is made up of other factors, one of which is that almost indescribable qualification of having a "good eye" for proportions, for good mechanical action—an eye that "feels" as well as sees when something is lacking or wrong and that gives the designer no rest until things look right and *are* right.

And being right includes not merely strength and stiffness in keeping with the stresses to be imposed on the parts, but several other properties as well, one or more of which may be as important, if not more so. In fact, it need not be an extreme case if all of the following must be considered in the design of a single piece:

Strength.
Stiffness.
Ease and cost of molding.
Ease and cost of machining.
Weight.
Internal stresses due to unequal cooling.
Change of form due to unequal cooling.
Room occupied.
Cost.

And while each of the above is considered that most important requirement of all, fitness for its purpose, must be kept in mind. In some cases other considerations of importance enter, and one who has looked upon the designer as a sort of failure because a new machine practically always requires some changes would be likely to withhold his criticism if he ever tried his hand at it and found what an amount of thought every line requires.

But to return to my subject: I by no means favor old-time methods; not when modern ones are better, but when I see the technical graduate almost adored my thoughts naturally turn to the practical men who can almost divine what others can only arrive at through a process of calculation and the touches of whose hands are visible throughout practically all successful institutions.

As the term "practical" has more than one definition, permit me to quote Funk & Wagnall's Standard Dictionary, definition third: "Trained by or derived from practise or experience; hence, skilled in the application of means in attaining particular ends; experienced; as, a practical teacher," etc.

I quote this because a practical man is sometimes considered as being entirely devoid of theoretical knowledge; a man who would guess, for instance, at the sizes of pulleys and width of belt required to transmit a given amount of power at the required speed.

To the contrary, such an one would be decidedly *im*practical. Being practical implies not only having gained much knowledge through experience, but as well having the ability to render this knowledge useful by sound reasoning with practical results in view and having the qualification of foreseeing the effects of causes *without* requiring to recall an equivalent case from previous experiences. This as distinguished from blindly picking formulas out of some textbook and as blindly applying these without considering factors tending to modify the result.

It is easily possible to cite examples

of many failures made by technical graduates through their lack of experience but equally many have been made by (so-called) practical men through not understanding the laws of physics; therefore such examples are better omitted.

I believe the practical man, as above outlined, will live forever; that no amount of college training will render equal to him men who have not that congenital mechanical ability that distinguishes them from from the ruck of mechanics. I also believe, however, that such men, efficient as they may be, should never despise technical education, for this, bestowed on the worthy (mechanically speaking), forms a valuable asset.

Among those entering the engineering colleges there are such men and they are the ones who profit most by the training there received, tho no doubt their education is not completed at graduation but they then are in a condition that enables them to be much more benefited by, and to more readily assimilate the experiences to be gained from the practical work following.

And these are the men who, had they by force of circumstances been confined to shop practise alone, would have become the practical men whose cause I champion. Let us, therefore, bear in mind that because a man has taken a course in college he is not of necessity an impractical figurehead, and also that one who has been confined to shop work is not necessarily a relic of the past, to be superseded by college-trained men sooner or later.

A photo-engraving plant for the manufacture of zink etchings and half-tone plates is in operation in the Graphic Arts section of the Palace of Liberal Arts at the World's Fair. Printing plates made by both of these processes are turned out daily. Photo-engraving is one of the crafts, allied with printing, about which little is known by the general public and the exhibit is of especial interest to visitors on that account, as every part of the process is shown and explained.

The manufacturers of taps have agreed upon the standard sizes for their product including hand taps, machine or nut taps, pulley taps and machine screw taps, so that hereafter these will be on the same plane as twist drills. Some of the pitches have been eliminated, especially in the line of machinists' hand taps. Thus in ¼-inch taps 24, 27 and 32 pitches are retained and 16, 18, 22, 26, 28 and 30 are dropped. The taps are shortened somewhat throughout the lists. The new lists are being included in the 1904 catalogs of the several makers, and in these by comparison full information may be found.

Over twenty-two thousand gross tons of German-built machinery was imported into Great Britain in 1903. A German paper calls the increase in this line six-fold.

Cone Pulley Bearing.

We have received from Gould & Eberhardt, of Newark, N. J., a letter in which they say:

"Referring to the illustration of cone-pulley bearing, under the heading of 'New Things,' at page 703, we call your attention to the fact that this is not a new thing, and embodies practically the same principles as our sleeve cone bearing and support, on which we were granted a patent under date of October 28, 1902, No. 712,273.

"A sectional drawing of our bearing was sent you August 8, 1902, together with a photograph of our shaper on which it was used, together with a description of it explaining that we were also using the same style of bearing which we feel has numerous advantages, on our automatic gear cutting machines. At the time we submitted this to you you expected to use it in your twenty-fifth anniversary number, but it was probably omitted through lack of space. It was, however, illustrated with views of both the shaper and the line drawing of the bearing in a number of the other papers about the same time."

Flake Graphite for Lubricating Air Compressor Cylinders.

The publication by us at page 614 of an article upon explosions in air compressors has suggested the propriety and pertinence of calling attention to a mailing card recently issued by the Joseph Dixon Crucible Company, Jersey City, N. J., on the use of flake graphite for the lubrication of the cylinders of air compressors. The following information and suggestion is presented:

"Certain important conditions are presented in the lubrication of air compressor cylinders, not encountered in the case of steam cylinders. Dust and grit drawn into the cylinders through the intake frequently set up destructive grinding. The heat is dry and tends to carbonize cylinder oils, especially compounded oils, clogging the outlet valves and choking the discharge pipes. If an oil of too low flash-point be used, explosive vapors are formed which high frictional heat at some point may accidentally ignite. A number of frightful explosions of air receivers have been traced to this cause."

It is further stated that flake graphite has been used for this service with most satisfactory results. It fills and overlays irregularities, scratches and the coarse grain of the metal, leaves a smooth and polished surface and the amount of oil used may be greatly reduced.

Civil Service Examinations.

The State (N. Y.) Civil Service Commission announces examinations to be held on July 9 for various positions, among which are those of architectural draftsman, bridge designer, bridge draftsman and photographic assistant. Applications must be made before July 5. Particulars and blanks may be obtained by addressing the Chief Examiner Civil Service Commission, Albany, N. Y.

Technical Publications.

"Uses of Electricity on Shipboard." By J. W. Kellogg. 78 5½x8-inch pages, with numerous illustrations. Marine Engineering, New York; E. & F. M. Spon, London. Price, $1.00.

This book is intended to place in the hands of marine engineers the information necessary for the intelligent handling of the electrical machinery in their care. The first chapter is a brief historical account of the beginnings of electrical work on shipboard, after which come chapters on General Considerations for Modern Plants, Wiring and Insulation, Electric Fixtures and Fittings, Electrically Driven Auxiliaries and Electric Wiring for a Small Steamer. An appendix gives particulars regarding small lighting plants for launches. The book contains in brief compass and clear language a large amount of information of the kind desired by those for whom it is intended.

In our issue of May 19, at page 657, second column, the figures given for the pounds of lime per ton of iron must have struck every reader as excessive and obviously incorrect. They were so on account of the unfortunate omission of the decimal point in each case. For the numbers 348, 350, 306 and 340 read respectively 34.8, 35.0, 30.6 and 34.0.

The main building of the Rensselaer Polytechnic Institute, Troy, N. Y., was totally destroyed by fire June 9. Built against and into the worthless face of a bluff, it was perhaps the worst situated educational edifice in the country. There will of course be an immediate rebuilding, but it is to be hoped that the many and strong friends of the institution will provide a better site.

The Pennsylvania Railroad Company on June 9 awarded a contract for the cement which will be used in its tunnel from Weehawken to Long Island City and in the terminal stations and power-houses connected therewith. The contract was secured by the American Cement Company, of Philadelphia, through its New York branch, the United Building Material Company. This will doubtless prove to be the largest contract for Portland cement ever given out. The largest contract of the kind hitherto was that for 1,500,000 barrels for the New York subway.

Personal.

E. F. Du Brul, who is retiring from the commissionership of the National Metal Trades Association, will organize a cement company to operate in Jackson county, Ohio.

W. F. M. Goss, dean of the Schools of Engineering of Purdue University, has received the honorary degree of Doctor of Engineering (D. Eng.), which was bestowed by the University of Illinois.

C. C. Tyler, formerly with the Pratt & Whitney Company, has resigned his position as superintendent of the works of the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., where he has been for some years past, to become general superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. He enters upon his new duties June 15 with headquarters at Milwaukee.

A lecture was delivered on "The Modern Machine Shop," before a large and representative audience, at the Carnegie Music Hall, Pittsburg, Pa., Monday evening, May 16, by Charles Day, of Philadelphia, under the auspices of the Carnegie Technical Schools, not the least interesting of which was the part dealing with the early history of the machine shop. The work done by such pioneers as Watt, Maudslay, Nesmyth and Whitworth was briefly reviewed and some of the original machines designed by them illustrated. The evolution up to the present day was traced through its various stages and graphically illustrated by lantern slides.

Obituary.

John Demarest, who died in this city June 4, eighty-three years old, was years ago considered one of the most expert foundrymen of his time. He entered the J. L. Mott Iron Works, of this city, in the days of the original proprietor, Jordan L. Mott, and in time rose to be superintendent of the entire works. Mr. Demarest, by his inventions and influence, had much to do with the development of modern sanitary plumbing. It is mentioned as a peculiarity, which in these days would scarcely be commended, that he never would go about to other foundries or study the work of other men. He is represented to have had no interests but those of his family and of the one business with which he was connected.

Business Items.

John C. McClure, patternmaker, Newark, N. J., is removing his business to 134 Orange street, that city, where he will have enlarged facilities to handle his increasing business.

The E. M. Dart Manufacturing Company, Providence, R. I., maker of the Dart union and pipe couplings, has recently received an order for over 8,000 Dart patent bronze seat couplings, to be used in the Imperial palace now under construction at Vienna, Austria. The business of the Dart Company is very brisk in both domestic and foreign orders.

Manufacturers.

The True-Tagg Paint Company, Memphis, Tenn., proposes to build.

John Pearce & Sons' woolen mill at Greenville, Pa., has been burned.

Waterhouse & Buffum, Blackinton, Mass., may build a new textile mill.

Swope Brothers, of Flinton, Pa., are to build a flour mill at Johnstown.

The American Show Print Company, Milwaukee, Wis., will erect a plant.

There is a report that the Grand Trunk intends to build big car shops at Battle Creek, Mich.

The Hoefer Wall Paper Mills, West Twenty-third street, New York city, have been burned.

The Standard Forgings Company, Chicago, has commenced work on a plant at Indiana Harbor, Ind.

The Crompton & Thayer Loom Company, Worcester, Mass., will, it is reported, erect a new building.

Virge Steger, of Bonham, Tex., is considering the establishment of a brick-making plant at Sedalia, Mo.

It is stated at Burlington, Vt., that the Leader Evaporator Company will erect a factory immediately.

It is rumored that a gas engine factory will be started at Clinton, Ia., by H. E. Walker, of Chicago.

Maggioni & Co., of Savannah, Ga., are establishing a large oyster canning factory at Port Royal, S. C.

Plans have been drawn for a factory building for Ding & Teuscher, cornices and skylights, Newark, N. J.

The contract has been let for building the Ohio Union Brewing plant on Spring Grove avenue, Cincinnati, O.

The Carborundum Company, Niagara Falls, N. Y., is about to build a factory addition, 50x186 feet, three stories.

Ball Brothers Glass Manufacturing Company, Muncie, Ind., fruit jar manufacturer, is preparing to erect an addition.

Utz & Dunn, shoe manufacturers, Rochester, N. Y., contemplate adding two stories to an 85x250-foot factory building.

The National Engine Company, manufacturer of gasoline engines, Rockford, Ill., has secured land for a new building.

It is proposed to establish a wheel factory at Red Creek, N. Y. Messrs. Hatfield & Jessup may perhaps give information.

The Moore Manufacturing Company, recently incorporated, is to have a canning and cigar factory at Bridgeport, W. Va.

The Muskegon (Mich.) Boiler Works, of which C. D. Stevens is the proprietor, is considering the erection of a new plant.

Howard Ensign is building a plant at Naugatuck, Conn., for selling and repairing automobiles and doing other machine work.

Collmer Bros., South Bend, Ind., have just erected a new building for the manufacture of tools for bicycle work and of bicycle parts.

The No. 4 breaker of the Lehigh & Wilkesbarre Coal Company (of New York city and elsewhere) at Audenried, Pa., has been burned.

The Edwin Bell Company, of Pittsburg, Pa., has bought a nail keg factory at Mardela, Md., which, it is expected, will be enlarged.

The Peerless Wire Fence Company is a new Adrian, Mich., industry. A factory will be built, and fence machines and fence manufactured.

Great damage has been done in a warehouse and other buildings of the Corning Distilling Company, Peoria, Ill., by an explosion and fire.

Morris & Lewis, Rock Island, Ill., have let the contract to build a brake shoe works in East Rock Island, comprising a foundry and machine shop. The building will be 100x300 feet.

The Tri-State Milling Company, which has an office in Nashville, Tenn., is about to erect a mill there with a capacity of 500 barrels of flour a day.

John N. Roberts, of Indianapolis, Ind., representing a company of capitalists of that city, has secured land near New Albany for a veneering plant.

The Addresso-Printograph Company has purchased the H. K. Day machine shop, Elyria, O., and will use it for the manufacture of its machine.

J. K. Innes and John Demarest, Binghamton, N. Y., may build a stove and furnace plant to employ about 100 men, and to include a general foundry.

The Waltham (Mass.) Clock Company has had plans drawn for a new plant, surmounted by a clock, with striking chimes that may be heard several miles away.

W. I. Wellman, who has heretofore assisted in securing enterprises for Huntsville, Ala., has arranged for the establishment of a cotton rope and twine mill.

The Victor Talking Machine Company has purchased a tract of land in Camden, N. J., and intends to erect a plant to take the place of the one recently burned.

The Sligh Furniture Company, Grand Rapids, Mich., has completed a new boiler and engine room and is about to build a four-story addition to the factory.

Arthur L. Richards has ordered plans for a light manufacturing building at Milwaukee, Wis., to be 100x150 feet, six stories and basement, and cost about $95,000.

The Holmes Company, a Georgia corporation, proposes to build a machine cooperage plant near Savannah, as a result of the labors of the Chamber of Commerce.

A new brewery is to be erected, probably in Camden, N. J., for Joseph Baumgartner. Koelle, Speth & Co., presumably of Philadelphia, are the architects and engineers.

A cotton mill is proposed for New Orleans, La., by Eastern capitalists. A site has been secured. Leo Fellman, of that city, represented the capitalists in purchasing it.

The Consumers' Electric Company, New Orleans, La., of which Jules S. Dreyfous is president, has bought a site for a plant. It will have boilers to the extent of 6,500 horsepower.

Steps have been taken at Salem, Mass., for the incorporation of the Colonial Automobile & Manufacturing Company, which proposes to store, care for, repair and even build automobiles.

The Wetzel Mechanical Stoker Company opened offices at Trenton, N. J., some time ago and has on the market a mechanical stoker of which large shipments have already been made.

The White-Blakeslee Manufacturing Company, Birmingham, Ala., gasoline engines etc., has this spring completed an enlarged and improved plant within sixty days after the destruction of a former one.

E. Children & Sons, Council Bluffs, Ia., manufacturers of cultivators, propose to enlarge their plant, consolidating therewith an implement factory to be moved from Omaha. New machinery also will be installed.

The officers of the Arcade Cotton Mills, of Rock Hill, S. C., have called a meeting to consider increasing the company's capital by $60,000. It is proposed to expend the money for machinery and other improvements.

Richey, Browne & Donald, Long Island City, N. Y., manufacturers of ornamental and structural iron work, have purchased a large parcel of property at Maspeth, Queens

Borough, on which they will erect a new plant.

John H. Ohnsman, of Beaver Falls, Pa., is stated to have negotiated the purchase of the Keystone Scale Works, of Beaver Falls, from the National Computing Scale Company. It is understood that the works will be put in operation.

The Pennsylvania Pump Company will build a factory in Davenport, Ia., or vicinity, with which place, we understand, it is now identified. It will continue the operation of a factory at Lancaster, Pa., but needs to increase its output.

The Washburn Lignite Coal Company, Bismarck, N. D., proposes to establish an experimental briquetting plant in connection with its works at Wilton, N. D., besides making other improvements in the way of ore-loading machinery, etc.

The International Power & Vehicle Company, Stamford, Conn., one of whose lines of manufacture is boat engines, is in communication with the Long Branch, N. J., Board of Trade, relative to the possible establishment of a plant there.

The seven-story building at 54-60 South Canal street, Chicago, known as Machinery Hall, has been burned. It was owned by Alderman W. T. Maypole and John Jacob Maypole, and occupied by several firms of manufacturing machinists.

The executive committee of the American Locomotive Company, at Montreal, has decided to expend $250,000 in increasing the size of all but two of the plants of the Canadian works. A large addition is to be built to the foundry department.

The Niagara Falls (N. Y.) Metal Stamping Company has been incorporated with $128,000 paid-in capital, and intends to erect a new plant. This is an expansion of the Metal Stamping Company, whose intention to enlarge its works we have already noted.

A company (capital, $150,000) has been organized by J. M. Kyser, hitherto manager of the Huntsville, Ala., plant of the Alabama Cotton Oil Company, and J. E. Butler, of New Hope, to establish at Huntsville a cotton oil mill, ginning plant, soap factory and fertilizer factory.

Several barrels of slack coal have been shipped by the American Fuel Company, of Denver, Colo., from Gallup, N. M., to Germany, where it will be tested for briquets. If the returns prove satisfactory the company expects to install a plant for the manufacture of briquets at Gibson, N. M.

Within the United States Steel Corporation, contracts have been awarded to the American Bridge Company by the National Tube Company for material for the big mills at McKeesport, Pa., which are to have a daily output of 1,500 tons. The tonnage of the Lorain, O., plant will be 1,000 a day.

The Metcalfe Manufacturing Company shops at Quincy, Pa., builder of gasoline and gas engines, have been burned. The concern is said to belong to the Geiser Manufacturing Company, of Waynesboro, which had intended to remove the machinery to Greencastle and will not rebuild at Quincy.

Plans and specifications are now being prepared for a central heating plant for St. Mary's Church, boys' and girls' schools and pastor's residence at La Fayette, Ind., the same to be ready for fall. Geo. F. Mug is chairman of the committee in charge of the work. Bids will be advertised for as soon as the plans and specifications are ready.

The people of Junction, N. J., are said to be so glad to get the new plant of the Trimont Manufacturing Company, pipe tools, etc., of Roxbury, Mass., that they will give the concern $12,000 in cash and an interminable electric light franchise and incorporate the place as the Borough of Trimont, in its honor. The railroads give tenement houses, etc.

It is stated in the City of Mexico that the department of fomento has granted a concession to Enrique de Pena de Penaloza for the manufacture of wire and wire rope and cables. It is rumored that he is a representative of A. Leschen & Sons, of St. Louis, Mo., and that the company will at once erect a factory, a leading specialty of which will be aerial steel cables for the use of mines.

The Coleman Manufacturing Company's cotton mill at Concord, N. C., is said to be advertised for sale under execution, the sale to be made by J. E. Stagg, of Durham, as trustee. The Coleman mill is believed to be the only cotton mill in the South owned and operated by negroes. Warren C. Coleman, a very worthy negro, who died not long ago, organized the mill, and had he lived it stood a show of succeeding.

Fenwick Freres & Co., 21 Rue Martel, Paris, have opened a new branch and store in Liege, Belgium, at No. 1 Avenue Blonden. They will have there an important exhibit of machine tools and will carry also a large stock of small tools. Their aims in locating the new branch in Liege are to work up more thoroughly this important Belgian manufacturing center, and also to make all proper preparations for the World's Fair to be held there next year.

B. Franklin Hart, Jr., hitherto with Edwin Burhorn, has established himself under the firm name of B. Franklin Hart, Jr., & Co., with offices at 143 Liberty street, New York. B. Franklin Hart, Jr., & Co., announce that they are manufacturers of boilers, stacks, tanks and plate steel construction in general. They have fully equipped pattern, foundry and machine shops, in connection with the boiler shop, and are prepared to make castings of all descriptions, finished or unfinished.

The E. J. Manville Machine Company, Waterbury, Conn., builder of wire-working, rivet and heading machinery, is erecting a new works in the eastern part of the city, near the Dublin street depot, and expects to get in it about September. There will be a machine shop, 350x50 feet, three stories, a blacksmith shop, 40x30 feet, and an office building, 65x45 feet, two stories. The plant will be equipped throughout in the most modern way, and will contain a large traveling crane.

New Catalogs.

Globe Iron Works, Stockton, Cal. Illustrated circular of "Truax" ore cars.

J. G. Blount & Co., Everett, Mass. Grinding and polishing machinery and speed lathes, illustrated by half-tone cuts. 6x9, pp. 29, paper.

Eugene Dietzgen & Co., Chicago, Ill. 1904-5 catalog and price list of drawing materials and surveying instruments. Illustrated. 6x8¾, pp. 411, paper.

Philadelphia Pneumatic Tool Company, Philadelphia, Pa. Illustrated folder describing "Pneulubric," a lubricant for pneumatic tools and air compressors.

National Twist Drill & Tool Company, Detroit, Mich. Illustrated catalog and price list of reamers, drills, milling cutters, etc. 5x7½, pp. 31, paper.

S. A. Woods Machine Company, Boston, Mass. "The Importance of Accurate Grinding," illustrating the Woods full automatic knife grinder. Folder.

The Heald Machine Company, Worcester, Mass. The American twist drill grinder, its construction and use described in detail. Illustrated. 6x9, pp. 20, paper.

G. R. Lang Company, Cincinnati, Ohio. Circular of Lang's "T" bolt heads for the chucking of work on planers, lathes, drill presses and other machine tools.

Acme Gas Company, Chicago, Ill. Acme gas plants for fuel, light and power purposes, with half-tone illustrations showing a number of installations. 6x9, pp. 30, paper.

The Lufkin Rule Company, Saginaw, Mich., and 48 Lime street, London, E. C. 1904 catalog and price list of measuring tapes, rules, etc. Illustrated. 4x8, pp. 48, paper.

Hanna Engineering Works, 820 Elston avenue, Chicago, Ill. Pneumatic compression yoke riveters, portable and stationary, described and illustrated. 6x9, pp. 16, paper.

Great Lakes Engineering Works, Detroit, Mich. Catalog descriptive of the "Great Lakes" twin vertical air pump and condenser combined. Illustrated. 3½x6, pp. 12, paper.

Niagara Machine & Tool Works, Buffalo, N. Y. Machines and tools for tinsmiths and sheet metal workers, including shears, punches, rolls, presses, etc. Illustrated. 6x9, pp. 117, paper.

Niagara Machine & Tool Works, Buffalo, N. Y. Illustrated catalog of tools and machines for working sheet metals, including presses, shears, punches, can-makers' tools, etc. 6x9, pp. 110, paper.

F. W. Braun Company, Los Angeles, Cal. "Annealing, Hardening, Tempering and Case Hardening," pamphlet dealing with the use of Braun's portable forge and tempering furnace. 3¼x6, pp. 16, paper.

Valley City Machine Works, Grand Rapids, Mich. Carving lathes, rounding, routing and rosette machines, twist machines, wood lathes and other wood-working machinery. Illustrated. 7x9, pp. 8, paper.

H. H. Franklin Manufacturing Company, Syracuse, N. Y. Catalog describing Franklin motor cars, including light cars, light tonneaus and touring cars. Illustrated by half-tones. 5½x9½, pp. 22, paper.

The Hurwood Manufacturing Company, Inc., Bridgeport, Conn. Illustrated circular and price list describing the "Weatherby" chuck, a new independent chuck this company is placing on the market.

Cleveland Automatic Machine Company, Cleveland, Ohio. Illustrated booklet setting forth some of the principal features of the Cleveland automatic chucking, worm milling and screw machine. 4x9, pp. 8, paper.

Lemley & Schultz, Chicago, Ill. Illustrated catalog and price list of friction clutches, pulleys, flange couplings, clutch couplings, hangers, pillow blocks, shafting, sprocket wheels, chain, etc. 5x7½, pp. 119, paper.

The George P. Clark Company, Windsor Locks, Conn. Booklets showing Clark's exhaust fans, hot and cold dryers, etc.; trucks, hand, platform and special; and rubber and all-iron truck wheels and casters. 3½x6, paper.

F. M. Davis Iron Works Company, Denver, Colo. Catalog No. 37 of ore milling machinery and mine supplies, illustrated. 6x9, pp. 84, and a number of sub-catalogs showing some of the principal products of this company.

The Hartford Blower Company, 140 Suffield street, Hartford, Conn. Catalog No. 60 of Hartford mechanical draft apparatus, showing applications of induced and forced draft systems. Illustrated by half-tone cuts and drawings. 5½x8, pp. 15, paper.

Brown & Sharpe Manufacturing Company, Providence, R. I. Toolmakers' calipers and dividers, catalog showing a new line of fine and delicate calipers and dividers made by this company, especially adapted for use in tool making. 3½x6, pp. 8, paper. Illustrated.

A Large Dividing Table.

BY H. G. KNODERER.

The development and production of electrical apparatus have frequently made necessary the design of special mechanical devices to facilitate manufacturing operations. The change from the use of a solid magnetic circuit, usually of gray iron, to the laminated steel construction, now generally standard for electrical dynamos and motors of large size, created a demand for a machine to quickly lay off and cut slots or key-ways in the core or frame on which the laminated steel punchings forming the magnetic circuit must be mounted.

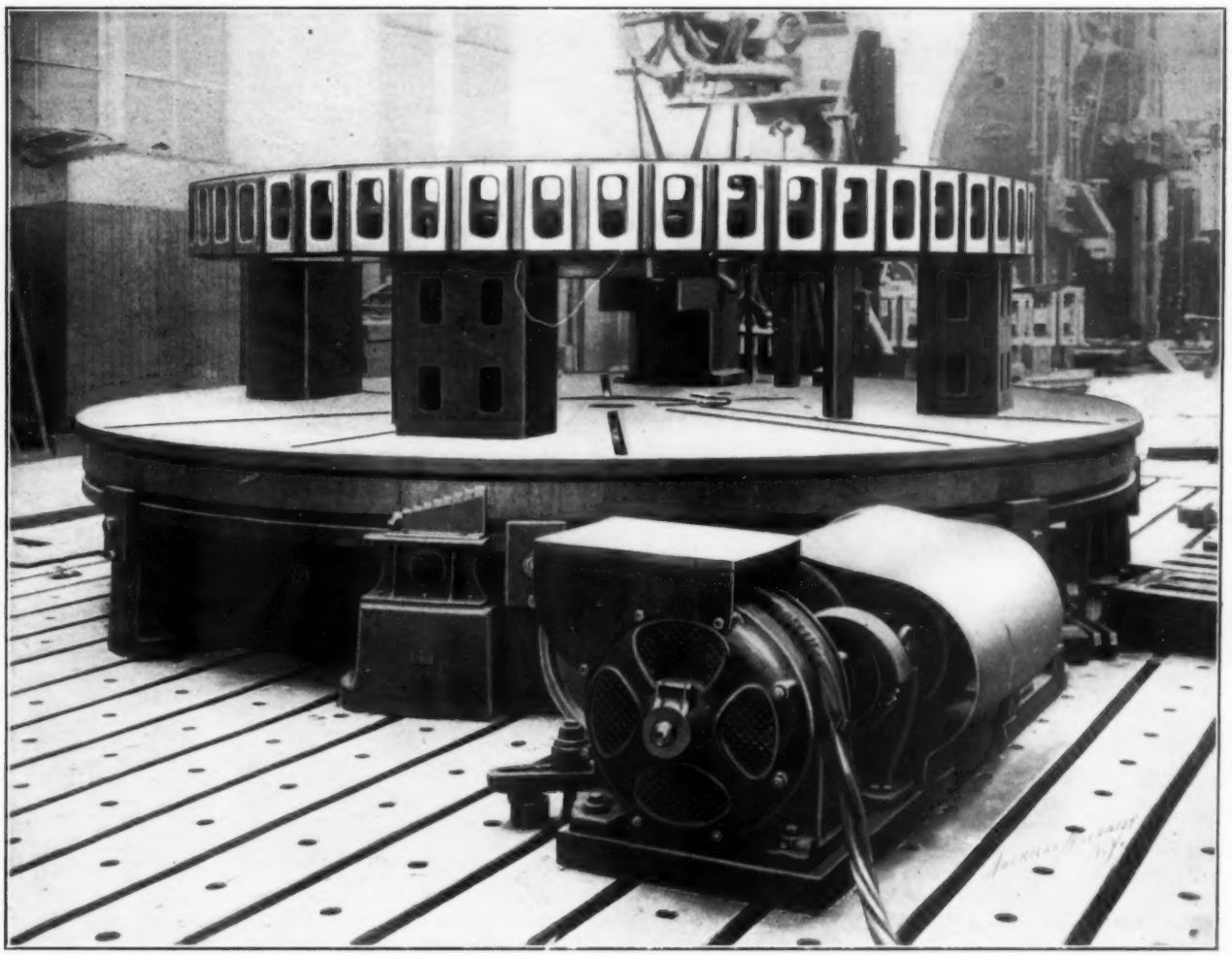


FIG. 1. THE DIVIDING TABLE WITH DRIVING MOTOR.

The first of these problems has been admirably solved in the works of the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., by the dividing table described below.

The laminated punchings which are to be built up about a core or within a frame have two sets of teeth. The teeth of one set form the slots within which the electrical winding is imbedded; the other teeth, which are in reality extensions from the body of the punchings, are fitted or dovetailed into key-ways cut in the supporting frame, so that the laminated punchings and the completed ring are firmly held in place. It is very important that this work be properly performed, and therefore necessary that the key-ways be accurately spaced. It is the function of the dividing table to perform this work.

This table consists essentially of a revolving bed, 14 feet in diameter, which rotates about a center ball-bearing. An annular bearing, which is hardened, ground and equipped with balls 1½ inches in diameter, serves as a balance, and also tends to reduce the bearing friction of the table. The diameter of the tramway is about 12 feet. The center ball-bearing, which is 4½ inches in diameter, revolves in hardened and ground cups, providing a practically perfect alinement. A small electric motor with friction clutches, shown in Fig. 1, operates the table, turning it through any desired arc. For accurate adjustment the motor clutch may be disengaged and the table turned to exact position by a hand wheel, shown projecting from behind the motor in Fig. 1.

The simple and inexpensive method employed in dividing this table depends upon the use of a special surveying instrument, shown in Fig. 2.

Owing to the greatly increased radius of the table over that of the instrument circle, special effort was made to overcome the inevitable errors due to direct reading of the instrument, and the means by which this was done form the chief feature of interest in connection with the construction of the table.

At a distance of approximately 100 feet a target was erected, consisting of a horizontal beam with an ivory marker mounted on each end. One of these markers was fixed in position, while the other was adjustable by a micrometer screw. A column was set in a concentric recess in the center of the table upon which the dividing instrument was set up. The number of divisions in a given circle being reduced to degrees and minutes, it was easy, by swinging the instrument through this angle, to so locate the movable target that the two targets should be split by the cross hairs of the telescope when in its extreme positions. This done, the micrometer reading was taken when the setting was destroyed, the table turned to a new position and the process repeated. At each repetition the micrometer reading was taken, and finally the average of all readings was taken. This being obtained and the micrometer set accordingly, the dividing of the table was done by the tar-

gets withot consulting the instrument circle. A first division being made with one of the targets split by the cross hairs, the table and instrument were turned together until the cross hairs split the second target, when a second division was made. The instrument was then swung to the first target, after which table and instrument were swung together to the first target and a second division was made, continued repetition of the process completing the circle. In order to avoid the effect of vibration, all this work was done on Sunday. Five circles in all were thus divided, these containing respectively 360, 114, 102, 96 and 56 divisions.

Before starting the dividing operation the table was approximately divided with dividers and the approximate position of each scale division was found. Holes ¼ inch diameter and ⅜ inch deep were drilled into the table rim at these points, brass plugs driven in as shown in Fig. 3, the table slightly recessed and the plugs faced. A simple device was rigged up on the rim of the table for marking the final division lines upon these plugs. This device consisted of a sharp V-shaped tool, a spring of definite tension and a release trigger. This device was placed in line with the dividing instrument and the ivory marker; the trigger set off, making a line of definite width and depth upon the brass plug. Starting from a fixed point the scale was thus laid off.

A vernier, shown in Fig. 3, is provided in the position of the starting marker to

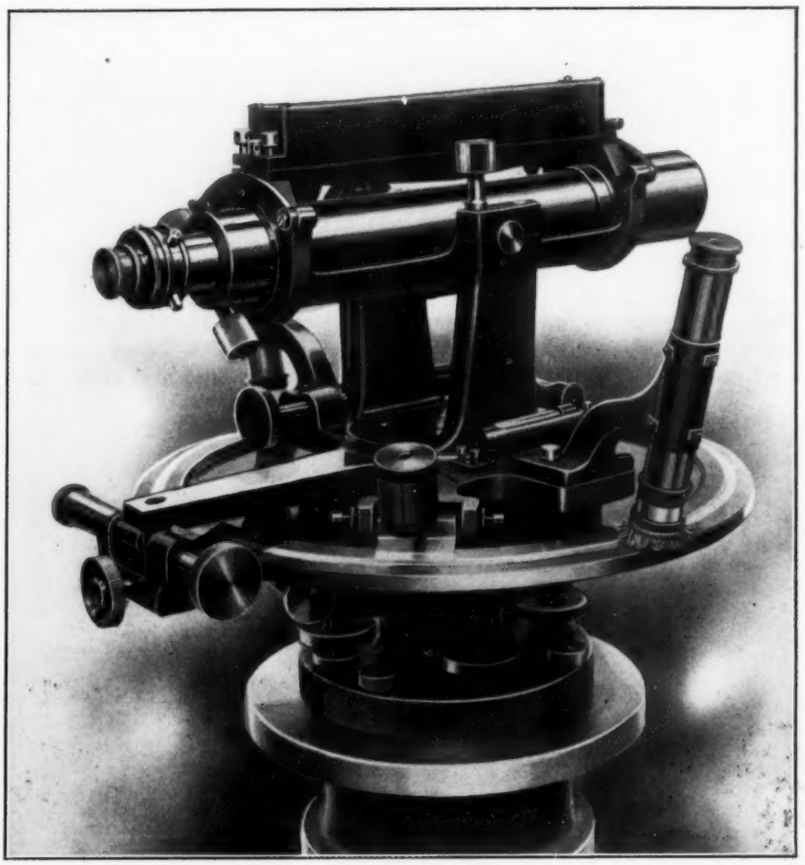


FIG. 2. THE LEVELING AND DIVIDING INSTRUMENT.

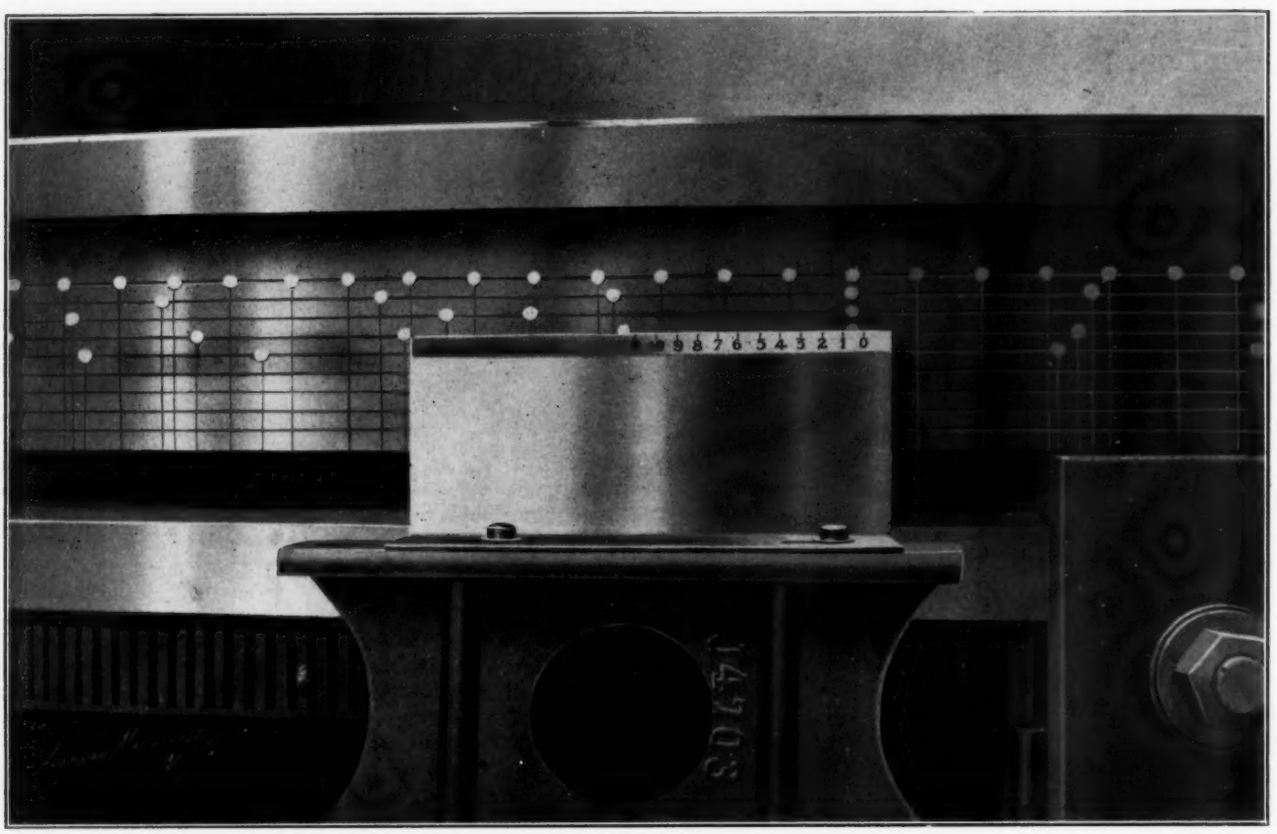


FIG. 3. ENLARGED VIEW OF DIVIDING TOOLS WITH VERNIER.

permit accurate subdivision of any ring scale. By this means exact adjustment may be easily and quickly made and the work divided accurately into any number of divisions

As an example of the work possible with this table, let us consider the preparation of the rotating element of a dynamo. The casting is lined up on the table, with centers coinciding. The center line of the first slot is obtained by stepping off in any available manner, from the joint between sections of the core. The tool is then adjusted and the first slot cut to proper depth. The tool remaining fixed, the table is rotated through the determined arc and the work brought into position for the second slot, and this process is repeated till all are cut as shown in Fig. 1, the slotting machine being seen in the background.

If the work be the stationary element, or outer frame, of a dynamo, the process is reversed. The work or casting is lined up on the floor, properly centered and the portable slotting machine mounted on the table. Proper adjustments are made and the slots stepped off and cut as before. A portable milling machine may also be mounted on the table to finish the work. Fig. 4 illustrates the two methods of using the table, a slotting machine being shown upon it and a milling machine upon the supporting floor plate. After setting the machine it is of course desirable to clamp the table firmly in position, and this is done by means of the vertical clamp shown in the different views.

The center ball-bearing of the dividing table provides a practically absolute center, which, together with the accuracy of the scale and adjustment, makes it possible to work within ten seconds of arc, a degree of accuracy necessary in the operation described as the steel punchings, or laminæ, must fit the casting exactly and the slots cut in their outside edge must line up straight to receive the copper conductors which constitute the winding of the dynamo.

Altho designed primarily for the slotting operation we have described, the dividing table may be used for other classes of work requiring circumferential division. Tho measuring but 14 feet in diameter this table has handled castings weighing as much as 100 tons. Its use has reduced the labor and time items of such operations about 90 per cent.

Work of similar character too large for the dividing table may be handled by the direct use of the leveling and dividing instrument which is employed to guide the adjustments of the slotting and milling tools. This instrument and its use has been thoroughly presented by Mr. C. C. Tyler in his paper, entitled "The Use of a Surveying Instrument in Machine Shop Practise," read before the American Society of Mechanical Engineers at the meeting held in New York city, December, 1902, and republished by us with additions at pages 226 and 260, Vol. 26.

The American Institute of Mining Engineers will hold its next meeting in the Lake Superior iron and copper regions, with the following itinerary: Saturday, September 10, leave Buffalo in the evening by the steamship "Northwest"; 14 and 15, in Duluth, leaving by rail in the evening of 15; 16 and 17, on the Mesabi range; 18 (Sunday), in Duluth; 19, 20 and 21, in Houghton and vicinity; 22, at Ishpeming Mich.; 23, in Chicago. A session will probably be held in St. Louis September 26. For any particulars address Dr. R W. Raymond, Box 223, New York City.

The oldest steam vessel in existence is said to be the Norwich, a side-wheel towboat still in service on the Hudson River. The engine is of the steeple type, with cylinder 40 inches in diameter by 10-foot stroke. She has been in continuous service since 1836.

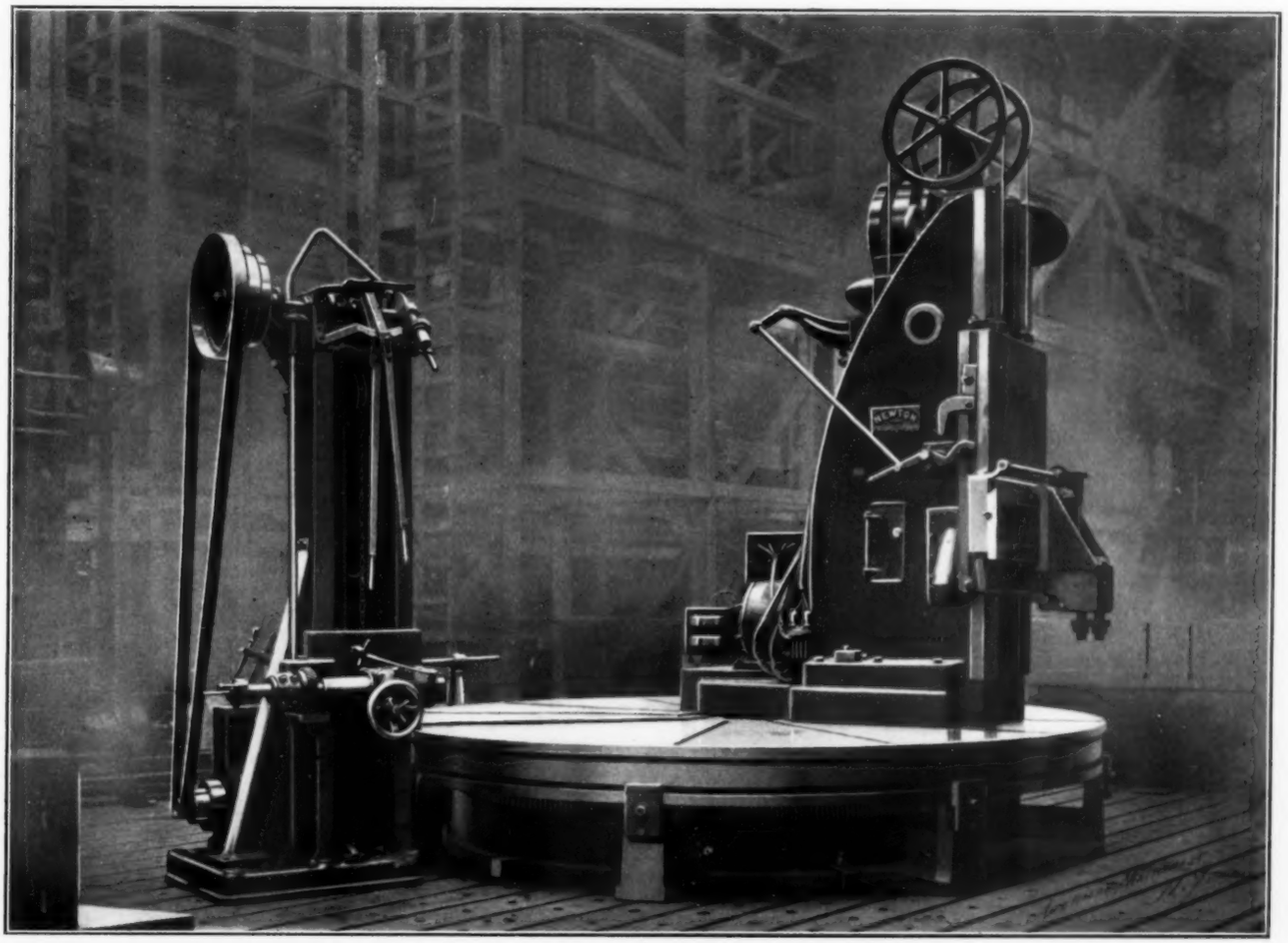


FIG. 4. THE DIVIDING TABLE WITH PORTABLE SLOTTING AND MILLING MACHINES.

Lathe Building Methods Used at the Works of the Lodge & Shipley Machine Tool Company.

BY C. F. PEASE.

HEAVY CASTING CLEANING.

To clean the surface of large castings when a first-class paint finish is required is a problem which has been only indifferently solved by some manufacturers and not at all by others who are still attempting to get along with only the hammer, chisel, a piece of broken emery wheel and an old file or two. The device illustrated in Fig. 1 is the solution the Lodge & Shipley Machine Tool Company has made of this subject and it has proven very satisfactory.

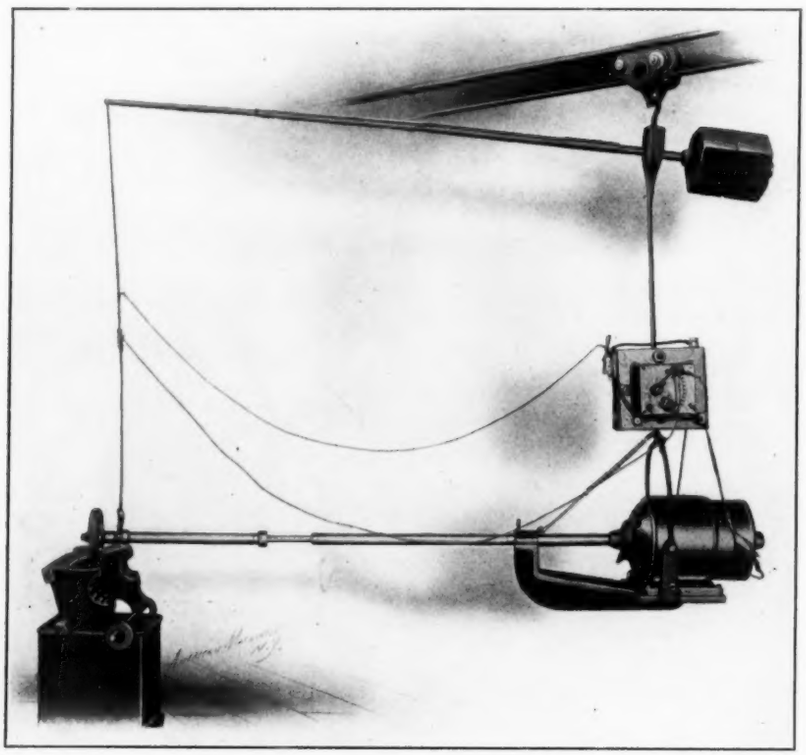


FIG. 1. CASTING CLEANING MACHINE.

Swung from a swivel, hooked to a 6-inch I-beam trolley which traverses the length of the casting shed, is a forked rod which supports a cast-iron case on which is mounted a 2 horse-power 110-volt 1,200-revolution-per-minute motor. This base is pivoted about centrally with the front end of the motor, and has a forward projecting arm carrying a bearing for a 2-inch tubular extension to the armature shaft. This tube receives a 1 3-16 splined shaft which forms a slip joint with about 3 feet of movement, and at its extreme end are flanges to hold a 12 or 14 by 1¼-inch emery wheel. A 2x24-inch loose knurled sleeve held freely between collars on this shaft just back of the emery-wheel flanges gives the workman the necessary hold to manipulate the emery wheel. The starting box and switch are mounted upon the forked rod which supports the motor and are operated by cords within easy reach of the workman without necessitating his releasing his hold upon the shaft. The grinder is nicely balanced by counterweights when the slip joint is in the shortest position. A couple of coil springs are provided to take the overload when the joint is pulled out to its maximum length so that the wheel will not come in contact with the floor should the operator release his hold.

With this device the entire side of a lathe bed 30 feet long can be completely surfaced with an emery wheel at one setting. It is used for cleaning all heavy castings which cannot be held up to an emery wheel conveniently, and has done much toward bettering the quality of the painted finish, besides cutting down the cost very materially.

ERECTING DEPARTMENT APPLIANCES.

One of the interesting features of the erecting department is the carriage scraping stand illustrated in Figs. 2, 3 and 4. After the carriage is secured in position by the several clamping screws it can be adjusted to either position shown in the illustrations. The horizontal position shown in Fig. 2 is used to rub in the cross-slide and to scrape such surfaces as may be accessible. To get at the angle of the dovetail, the positions shown in Figs. 3 and 4 are used. The carriage department is equipped with six of these stands.

One of the labor-saving devices on the erecting floor is the air-drill stand illustrated in Fig. 5, which is simply a rough gray-iron flange with a piece of gas pipe driven therein. A hand-wheel with the hub bored and tapped to fit a threaded rod, on the upper end of which is welded a double-end fork, provides the means of supporting and adjusting the elevation of the air drill. A setting of this device for drilling a headstock for the sliding tumbler push-pin is shown in Fig. 6 and is self-explanatory.

STOCK BOXES.

In the assignment of small stock, such as screws, nuts, etc., for a lot of lathes, a system of compartment stock boxes is used, two of which are shown in Fig. 7. Every department is provided with these boxes in duplicate, one of which is always in the stockroom filled or being filled for

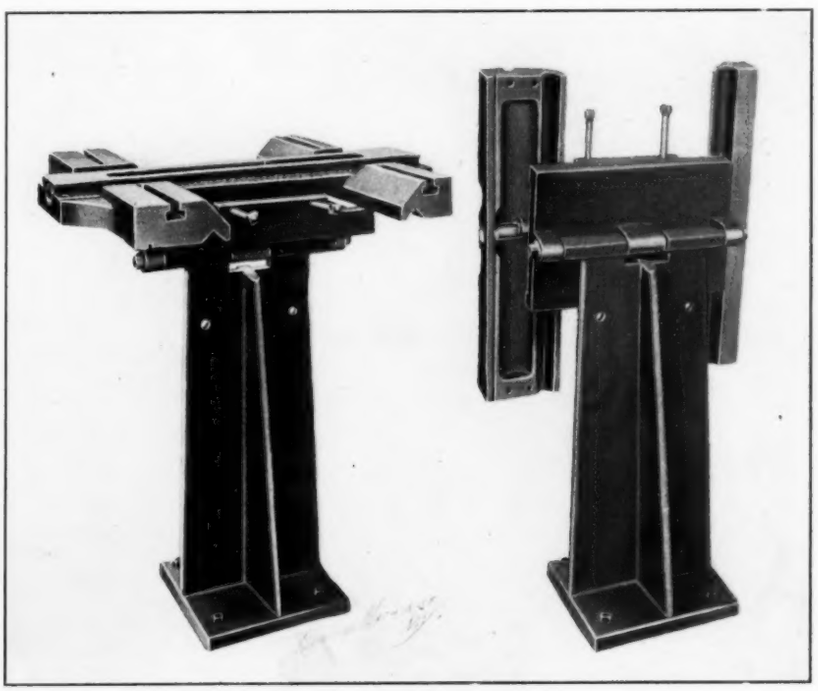


FIG. 2. CARRIAGE SCRAPING STAND. FIG. 3.

the next lot of machines to come on the floor.

The boxes are substantially built, iron bound and painted white, with the department stenciled in black on the cover. Each box is divided up into compartments to accommodate the quantity of each size screw, nut, pin, spring, key, bolt or washer required in the department for any given lot of lathes. Each compartment is marked with a small brass strip fastened to the edge of the partition and numbered to suit the line and page of the printed part lists issued from the superintendent's office, in which a uniformity of position of parts for a given purpose is maintained. This allows the box to be used for any size of lathe.

By the use of the duplicate set of boxes, the stock for the coming lot is insured against a possible shortage, as they are filled some time in advance of actual requirements.

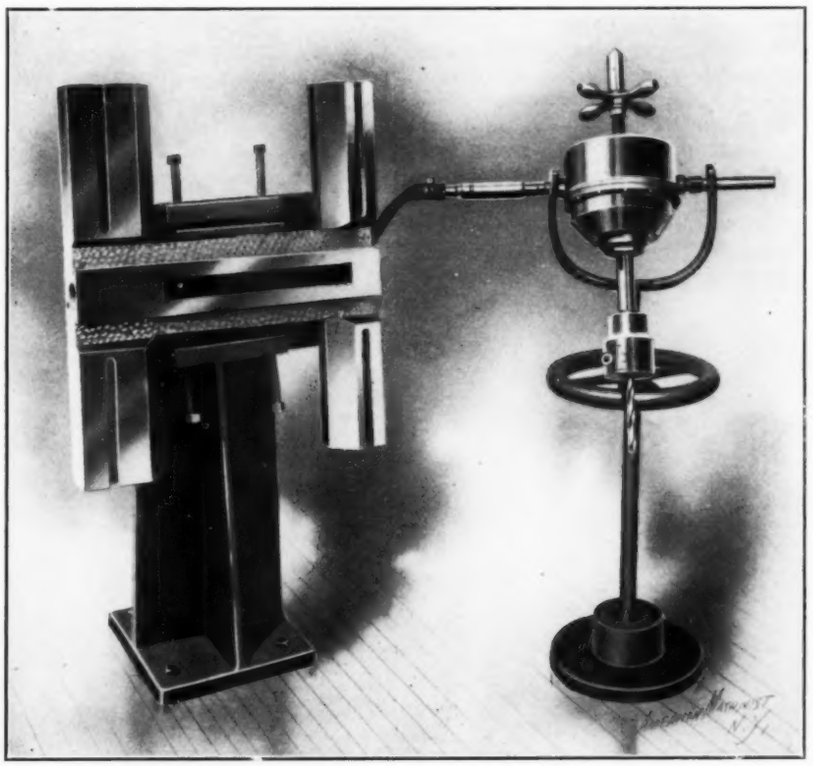


FIG. 4. CARRIAGE SCRAPING STAND.

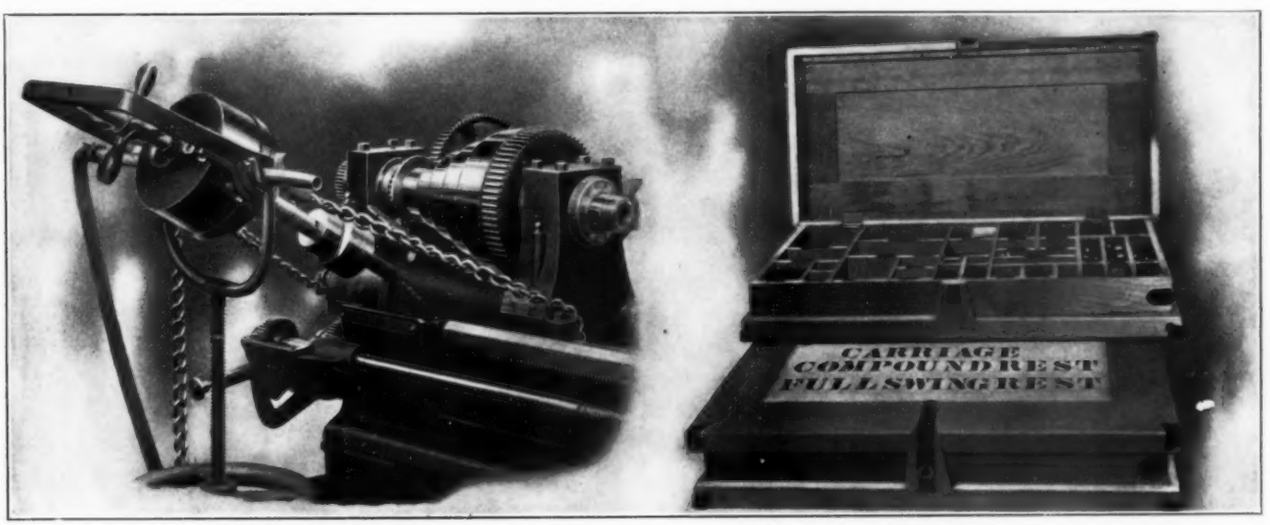


FIG. 5. AIR DRILL STAND.

FIG. 6. AIR DRILL STAND IN USE.

FIG. 7. STOCK BOXES.

The man that puts the finishing touches on a piece of wood work can spoil all the good work that has been done on it up to that point.—*The Woodworker.* It's just the same with steel or gold or any other stuff.

Sounds from the Rockies.

BY S. A. WORCESTER.

Queer things sometimes happen to the machinist in the mountains. A miner once brought me the piston for a 3½x5-inch cylinder belonging to his hoisting engine, which was on the range across the valley, six miles away. He said it leaked badly and would only hoist the bucket very slowly. The rings were loose in the piston and much worn, so I made him a new pair of snap rings and fitted the piston to them and sent him away, saying that the new rings would probably cure the trouble. He was back the next day before noon, saying that the engine was no better than before and I would have to come out to the mine and fix it. So I got into the buckboard with a few tools and jolted six miles out to the mine and looked at the hoist. The vertical engine frame, attached to the side of the 30-inch by 6-foot upright boiler, formed an exhaust steam feed water heater, and the exhaust pipe, connected by a flange to the top of this heater, made two right-angle bends and then turned up in the stack. When I opened the throttle quickly the engine made one or two quick turns and then slowed right down and refused to run more than 100 revolutions per minute with wide-open throttle and no load. I listened for the exhaust, and instead of a loud puffing there was only a very slight hissing sound. My conclusion was that the exhaust was stopped up. I removed the exhaust pipe and allowed the exhaust to blow freely out of the engine frame, and the engine then ran off in good style as soon as the throttle was opened a little. I then poured the exhaust pipe full of water at the flange end, and it was several seconds before water appeared at the other end, and then only dripping very slowly. A great deal of tallow had been used in the cylinder and had baked very hard in the upturned end of the exhaust pipe in the heat of the stack. By heating it red

hot in the smith's fire and hammering it and punching it out with a rod I got the pipe cleared in about an hour, and replaced it on the engine, and left the miner in a good humor.

There were at one time many hoisting engines of this particular 3½x5-inch size in the Leadville region, nearly always run by unskilled men, and many and peculiar were the troubles of these men. In at least three cases where I was called to locate trouble with this style of engine, I found that the slide valve and seat had worn so that the stem, which passed through holes in lugs on the valve, held it away from its seat, allowing the steam to blow right through to the exhaust. In one case I found the valve seat, which was only about 3 inches square, worn, or rather cut, 5-16 inch deep and the valve cut out almost as badly. No oil had been used for months on this valve. The mine-gineer didn't know it needed oil.

Probably the most frequent cause of the miner-engineer's troubles was the injector. The water was usually taken from a barrel, and dirt, sticks and waste would often put the injector out of commission. Sometimes the engineer was smart enough to disconnect the injector and bring it to the shop, where the trouble was soon rectified. Then perhaps he would not get his suction connections tight in putting it together, and the machinist would have to go to the mine after all.

A Hancock inspirator came into the shop one afternoon, needing to have one of the jet plates faced, the little lip around the opening having been worn out of shape. I had an important job chucked in the 18-inch Putnam lathe and had several hours' work yet to do on it, so I thought that in order to get the inspirator man going I would take the old back-number lathe with a right-hand cross-feed screw. I had to drive the jet plate on a little ⅛-inch mandrel and face it up. After some trouble, and just about 6 o'clock I got the jet faced up, and to withdraw the tool I turned that horrible cross-feed screw the wrong way, knocking the piece out of the lathe, cutting a gash in the jet plate and bending the little mandrel so that I had to make another one, and I worked nearly two hours to get the job finished, while the man stood and waited for it.

At another time I rode twenty miles in a buckboard, with a mine owner, to his mine, to locate trouble with a steam pump, which was at the bottom of the shaft. Climbing down the ladders about 200 feet and opening the pump, I found the slide valve was missing. No one knew how it got lost. It only cost them about $15 to learn what the trouble was.

Another mine owner came ten miles by stage and forty by rail and took me to his mine to see what was the matter with his hoist. It was a 9x12-inch, double-cylinder, link-motion hoist, and as soon as it began to squeak loudly he had the engineer, a miner who never handled an engine before this one, shut down, while he, the owner, made his trip to the shop. I took the train with him at about 6 P. M., and after forty miles of railroading and ten of staging we reached his boarding house, where we slept till about 6.30 A. M. Going with him half a mile to the mine, I gave the engine a little steam, and found a loud squeak in the left-hand link motion. By moving the reverse lever with the engine in various positions, I found that the link block was cutting on its pin. I knocked the pin out and dressed the burr on the pin and in the block, polished them a little with emery cloth and replaced them. The actual time of locating and remedying the trouble was less than one

FIG. 1. MACHINERY END OF TRAVELING SHOP.

hour, with poor facilities. The cost to the owner, including his expenses and mine and shut-down, was probably from $30 to $50.

The shop in which I finished my apprenticeship as a machinist had a well, about 3x5 feet inside and 30 feet deep, for supplying water for the boiler. A steam pump in this well, about 15 feet below the ground line, raised the water to a small tank, from which the injector fed it to the boiler. I used to get down in this hot well every two or three weeks and spend more or less time monkeying with this pump, which suffered from general debility and was worn out before the firm got it at a scrap price. Sometimes the shop would shut down an hour or two and wait for water. I usually skinned or scalded a few new places and par-boiled myself generally whenever I visited that pump, and it was becoming a great bugbear; so noticing several back-number injectors in the scrap, I persuaded the manager to let me try one of them as a steam-jet pump. I placed it well under the water, close to the bottom and made a strainer of a tin can with plenty of holes punched in it. I piped steam to the injector and a discharge to the tank. The whole job was done in about two hours, and the rig did the pumping cheerfully for years with no further attention beyond turning the steam on and off.

Ouray, Colo.

A Traveling Railroad Machine Shop

The half-tones give us two interior views of a traveling machine shop employed with profit and satisfaction by the Morgan Construction Company, Worcester, Mass. The business of this company includes the erection of large buildings and extensive plants such as rolling mills, and in such work it is frequently found necessary to have on the ground several machine tools, and the shop here shown neatly and effectively supplies this want. The car exteriorly is an ordinary 80,000 pound capacity box car; it is sent to a plant when the erection begins and remains there on a siding ready for the unexpected jobs that come along until the work is finished and then it can be at once sent to another job. The car has the standard inside dimensions of 8 by 6 by 36 feet. The windows are sunk into the sides and ends of the car, and when on the road these are all so neatly covered that the openings are scarcely noticeable.

Fig. 1 is a view of the interior, looking toward the end containing the machinery. An 8 horse-power gasoline engine does the driving, the tank for the gasoline, 74 gallons, being bolted under the car. For cooling the engine cylinder a vertical 300-gallon tank is used, seen in the right-hand corner of Fig. 1. The exhaust muffler is under the car. The engine drives by a belt to a friction clutch pulley, so that the shaft may be stopped without stopping the engine. The main line of shafting is 1 15-16 inches diameter and 15 feet long; the drive of the cross-shaft explains itself. There is a 20-inch Reed lathe, an 18-inch Stockbridge shaper, a Norton emery grinder, a portable forge, (not shown), an anvil, a bench and vise, and a good assortment of small tools and supplies. It seems strange that no upright drill is provided.

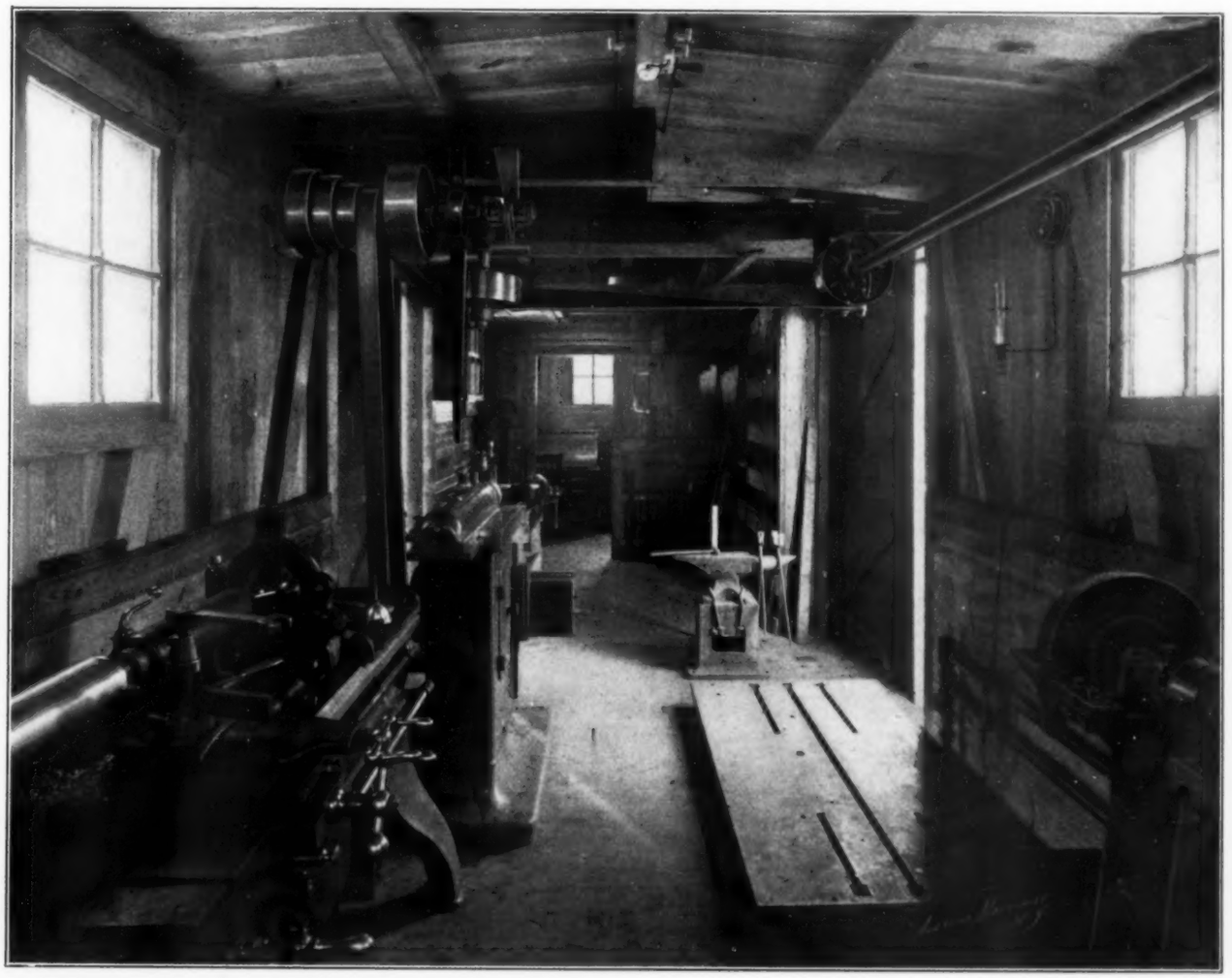


FIG. 2. OFFICE END OF TRAVELING SHOP.

The car is wired so that it can be electrically lighted, taking the current from any available source, acetylene lamps being provided for use when electricity is not to be had. There are also steam pipes for heating.

Fig. 2 shows the other end of the car where there is an office section with desk, chair and cabinet for blueprints. There is also a sink and toilet case and mirror.

Automatic Screw Machine.

An automatic screw machine of recent design and containing some features of novelty and interest is illustrated by the accompanying engravings, the half-tone, Fig. 1, representing the machine as a whole, and the line cuts bringing out the construction of various details.

As will be seen from the general view, the spindle, which is equipped with the usual spring collet and feed tube, is driven by open and crossed belts operating constantly and in opposite directions two friction pulleys either of which may be automatically clutched as required to the spindle. The forward pulley has near its outer edge a narrow friction band engaging with the inner face of a friction disk carried at the front of the pulley and serving to drive the train of gearing through which the main shaft below is operated. The short shaft carrying this disk and driven by it is mounted in a bracket which may be slid to and fro—parallel with the spindle—by means of a vertical lever actuated as indicated by adjustable cams on the slotted drum below; and thus the speed of the disk and its shaft may be varied automatically at any point in the rotation of the main shaft. The disk shaft transmits motion to a shaft in front of and parallel to the spindle, through worm and gear; and the shaft just alluded to, through spiral and spur gearing, actuates the worm for driving the main shaft. The mechanism leading to the latter will be understood from Fig. 2, which is a vertical section through the worm and a part of the gearing.

In this view *a* is a spiral gear shown near the left-hand end of the upper shaft in Fig. 1, and driving, through spiral gear *b* and friction connected spur gear *c*, another gear *d* secured on shaft *e*. The latter has at its rear end the sun-and-planet gear *f*, and when a pawl (not shown) at the side is engaged with ratchet teeth on *g*, thus preventing this member of the differential gearing from turning, the hollow shaft carrying the worm is, of course, rotated at a slow speed. This tubular shaft, however, carries at the front end a clutch *h* by which it may be connected direct to driving gear *d*, it then rotating at the usual high rate of speed employed for hurrying the mechanism along when the tools are not cutting. The clutch is shifted by a forked bell-crank *i* which is actuated by cams adjustable along the edge of narrow drum *A* (Fig. 1); it is held either in or out of engagement with the clutch teeth on gear *d* by a notched plunger *j* which acts upon a roll at the inner end of the bell-crank. The variable-speed drive obtained through the friction disk may thus be used for varying the speed of the cutting tools and also for changing where desirable the speed of the various parts during their idle or return movements.

The feed tube for the stock is drawn back and forth by a yoke whose hub is threaded internally to fit a multiple threaded sleeve cut coarse pitch and carried on a stud secured at the end of the head. This sleeve is turned to draw the feed tube out by a toothed plate attached to *B* (Fig. 1) and engaging with a pinion formed on the inner end of the sleeve. A second toothed plate on the inner face of *B* causes the feed tube to be moved ahead by acting upon an intermediate gear meshing with the pinion just referred to. The chuck opening and closing cams are carried on drum *C*.

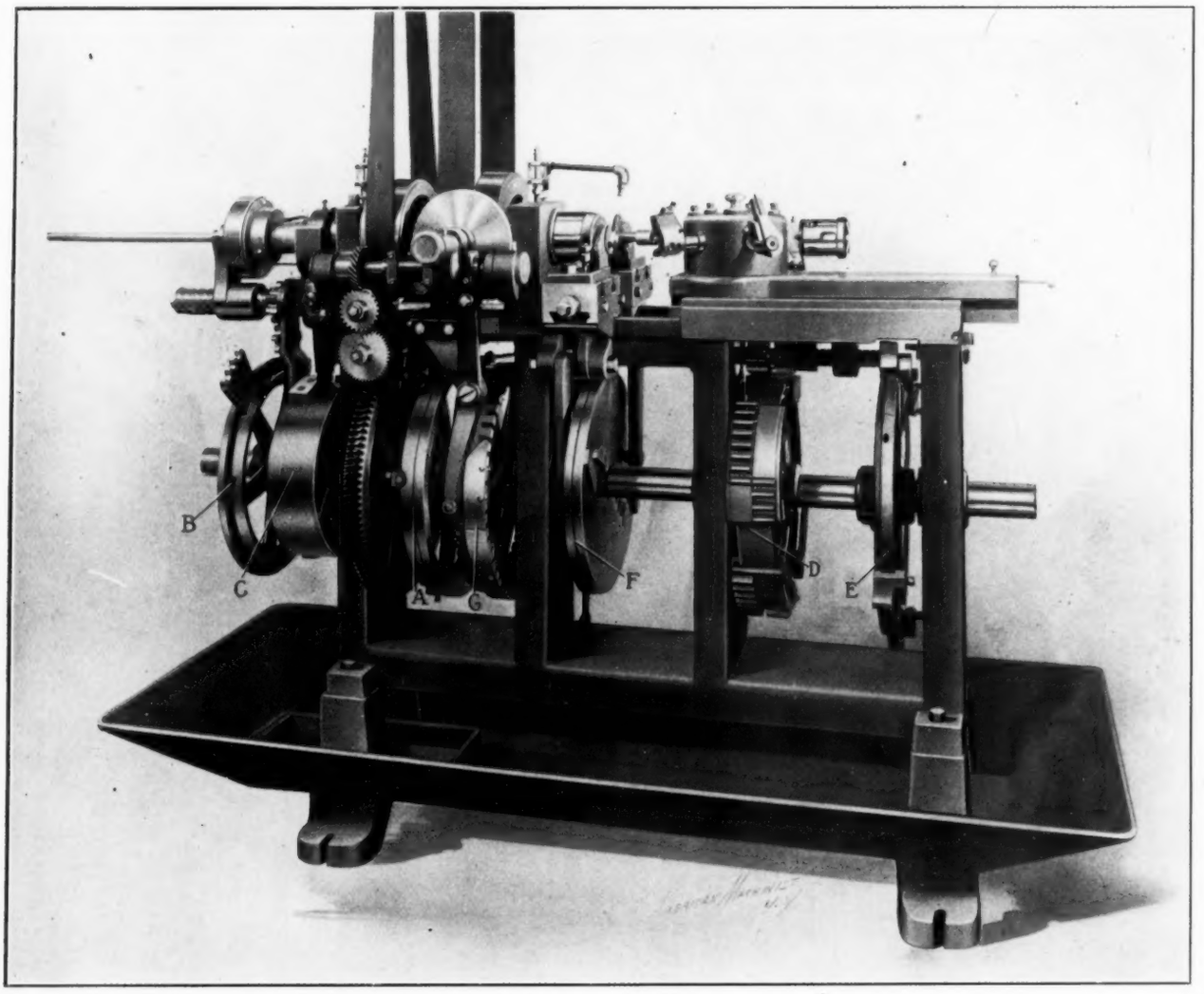


FIG. 1. AUTOMATIC SCREW MACHINE.

The turret actuating mechanism is shown in Fig. 3. The feed of the slide is through the coarse pitch double thread screw *k* which passes through a nut in a lug extending downward from the bottom of the slide. At the end of the screw is a pinion *l* geared to a short shaft *m* at the rear. When the short series of gear teeth on plate *n* carried by wheel *D* engage pinion *o* the turret slide is fed forward to the work; when the longer series of teeth on the same plate are brought into contact with the gear *p*, the feed screw is turned in the other direction and the slide run back. As it approaches the end of its travel rearward a cam *q* on disk *E* strikes a vertically movable plate *r* and lifts toothed lever *s*, with the result that the locking bolt, which is provided at its rear end with rack teeth, is drawn out of the turret ring notch; at the same time a tooth at the side of the cam strikes a gear wheel on shaft *t*, the latter through a pair of bevel gears turns the turret ahead one notch, and the locking bolt again springs into place. The end of lever *s* projecting at the rear forms a means by which the lock bolt may be withdrawn at any time if desired to turn the turret by hand.

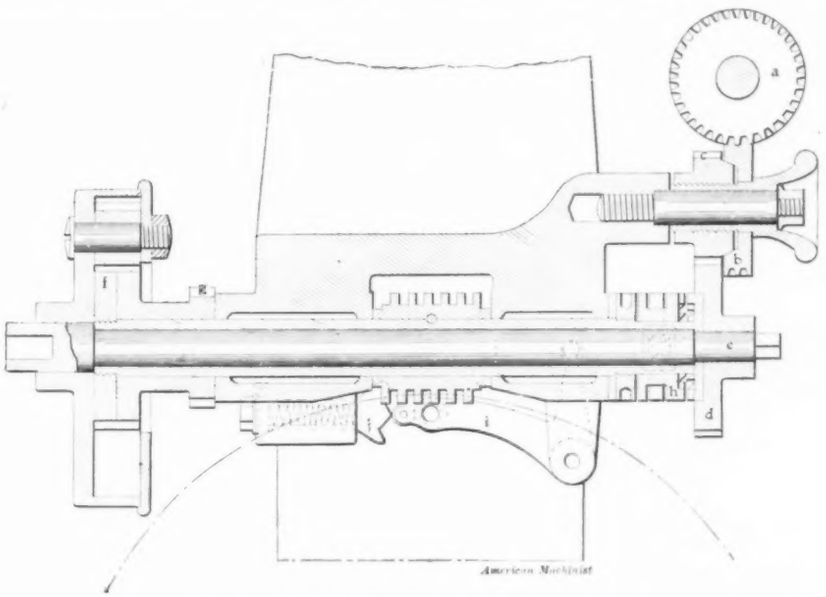


FIG. 2. SECTION THROUGH WORM DRIVING GEAR.

The cross-slide is constructed in two parts, as shown in Fig 4, and front and rear slides are independently operated by levers whose lower ends carry rolls engaged by cams attached to opposite faces of carrier *F* (Fig. 1). This is composed of a circular plate *u*—adjustably bolted to flanged casting *v* secured on the main shaft—and a ring *w* which is clamped between the outer disk and the flange on *v*, the ring being bored out taper to fit a corresponding surface on the flange. By loosening the clamping bolts the two cam plates *u* and *w* may be adjusted to bring the cross-slide cams to any required position relatively to each other or to the rest of the mechanism on the shaft. The method of connecting levers and slides, and the means for adjusting the latter are clearly shown and need no explanation.

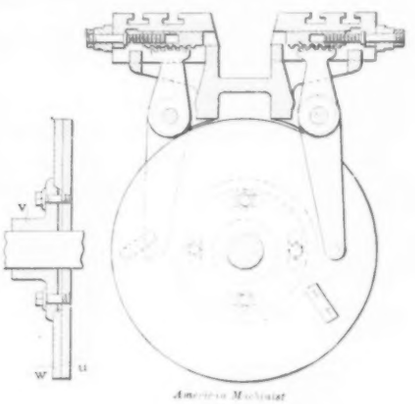


FIG. 4. CROSS-SLIDE MECHANISM.

The cam carriers *A*, *D*, *E*, *F*, *G*, are all provided with graduations, and the settings for different speeds and feeds and for

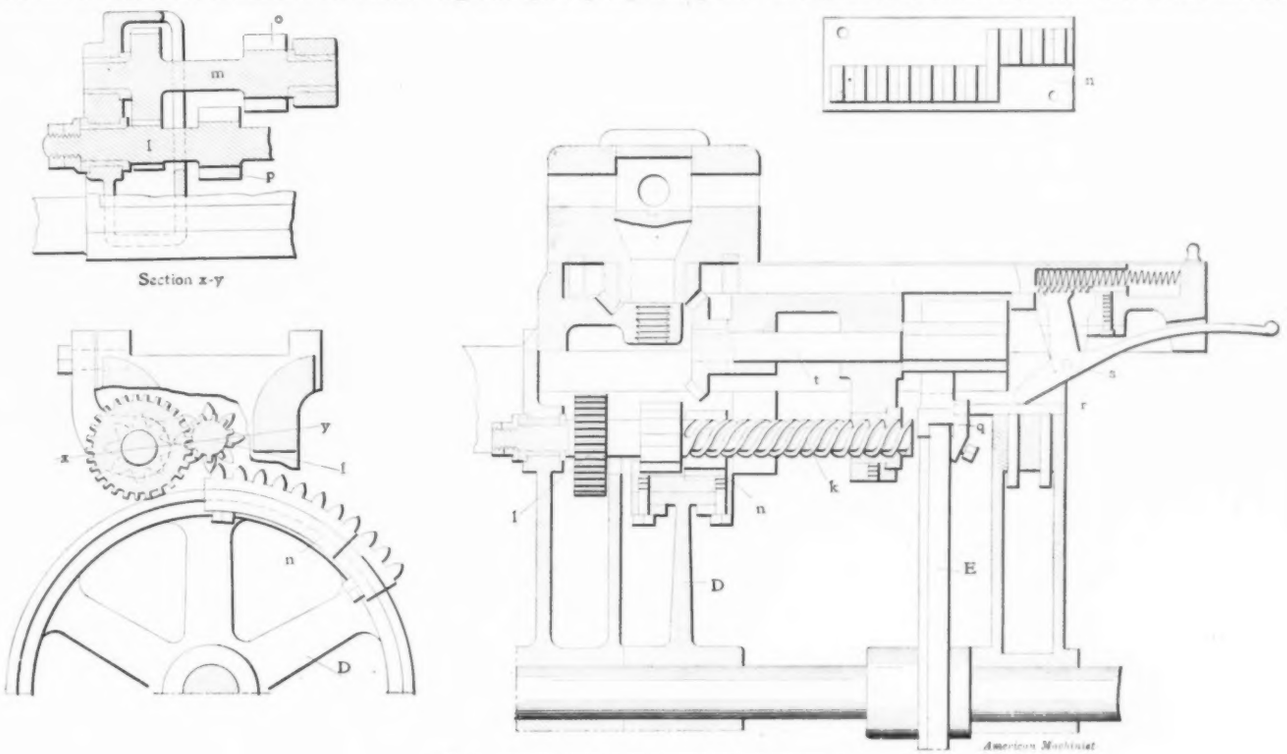


FIG. 3. MECHANISM FOR OPERATING TURRET.

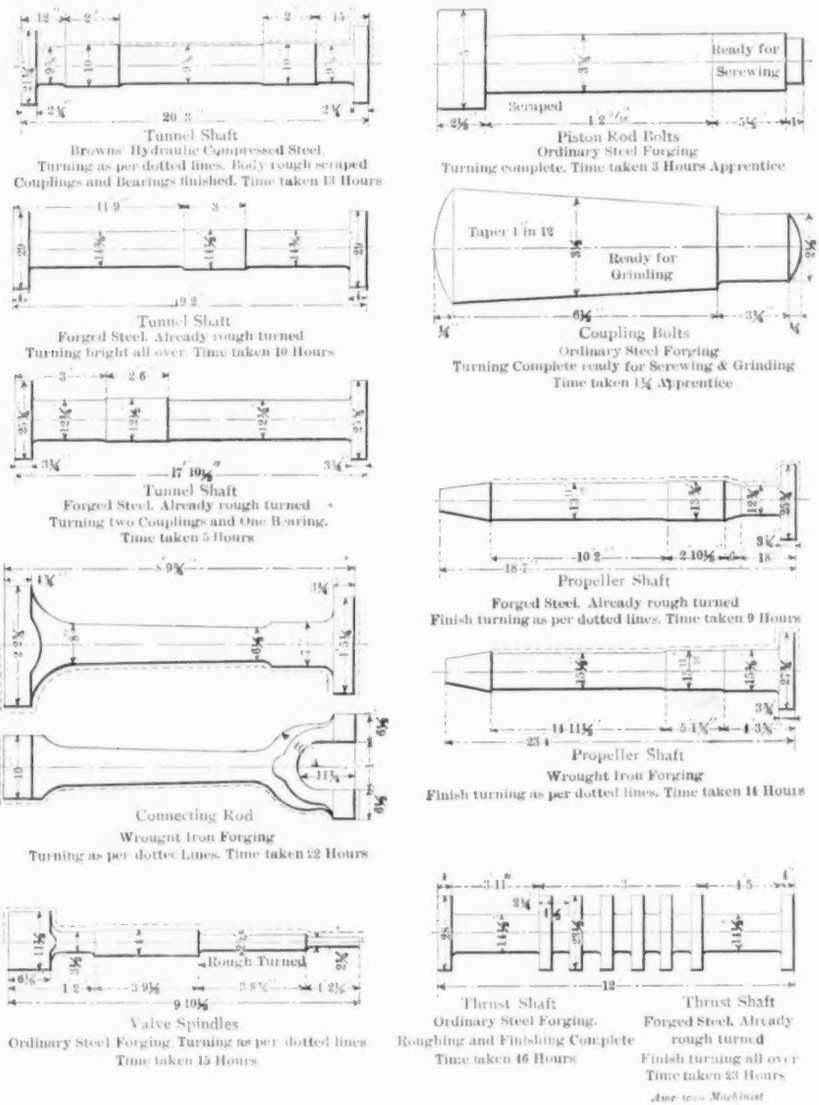
timing the cross-slide and turret movements are easily and quickly made. It is clear that with the mechanism arranged as shown, the turret may be quickly turned one, two or three holes, if only a few tools are being used; and the forming and cut-off tools may be brought into action at any point in the rotation of the turret by simply turning the cam disk upon its carrier.

This machine is the design of J. P. Lavigne, master mechanic of the Detroit Lubricator Company, Detroit, Mich.

More English Results With High-Speed Steel.

The accompanying illustrations of lathe work with high-speed steel tools are clipped from *The Engineer*, of London, and form a graphic, tho condensed, exhibit of the progress in the use of these steels in England. Of the illustrations our contemporary says:

"The illustrations show very graphically the great advances that have been made in the turning of steel during the last few years. For the greater part the examples given come under the head of heavy turning; the work which they illustrate was done without any idea of establishing records. They are regular, everyday shop figures, which there is a certainty of repeating ninety-nine times out of a hundred. We believe we are right in saying that the lathes on which they were obtained are not of very recent design, but we may be confident that they were worked at their utmost capacity, since the premium system is in force in the shops. All the information that can be needed about the diagrams is given on them. The great thing to remember is that these are not trial results. The figures are based on everyday records. The lathes have been run at the maximum speed practicable, and in many instances this speed has been fixed by the vibration of the work if a higher speed were used."


Tunnel Shaft
Browns' Hydraulic Compressed Steel.
Turning as per dotted lines. Body rough scraped
Couplings and Bearings finished. Time taken 13 Hours
Tunnel Shaft
Forged Steel. Already rough turned
Turning bright all over. Time taken 10 Hours
Tunnel Shaft
Forged Steel. Already rough turned
Turning two Couplings and One Bearing.
Time taken 5 Hours
Connecting Rod
Wrought Iron Forging
Turning as per dotted Lines. Time taken 22 Hours
Valve Spindles
Ordinary Steel Forging. Turning as per dotted lines
Time taken 15 Hours
Piston Rod Bolts
Ordinary Steel Forging
Turning complete. Time taken 3 Hours Apprentice
Ready for Screwing
Scraped
Coupling Bolts
Ordinary Steel Forging
Turning Complete ready for Screwing & Grinding
Time taken 1¼ Apprentice
Taper 1 in 12
Ready for Grinding
Propeller Shaft
Forged Steel. Already rough turned
Finish turning as per dotted lines. Time taken 9 Hours
Propeller Shaft
Wrought Iron Forging
Finish turning as per dotted lines. Time taken 14 Hours
Thrust Shaft
Ordinary Steel Forging.
Roughing and Finishing Complete
Time taken 46 Hours
Thrust Shaft
Forged Steel. Already rough turned
Finish turning all over
Time taken 23 Hours
American Machinist

ENGLISH RESULTS WITH HIGH-SPEED STEEL.

The University of Tennessee, Knoxville, has sent us a copy of its recently issued vest-pocket "Manual for Engineers." It contains a number of the most useful tables which are found in all the "pocket-books," and various items of information concerning the university.

Developing the Surface of Spherical Roofs by Calculation.

BY JAS. CLARK.

In a general plate shop the development of the surface of a sphere, in the case of umbrella roofs, or roofs which are segments of spheres is a common problem and is not considered difficult by the average layer out, but the method generally used of drawing it out on a sheet either full or half size, and using long radii in laying out the sheet proper, is not very convenient under some conditions. We had a number of these roofs of large diameter to make when the weather was cold, and the shop did not have room available for this method, and I took up the problem of finding a more convenient way. The following is a description of the method I developed:

Figs. 1, 2 and 3 are plan and side elevations of a hemispherical roof, $G\,F$ being the width of one sheet from which the roof was to be made. This width determines the angle α, which is one-half the angle included between the two cutting planes, whose intersections with the surface of the sphere determine the curve of the roof sheets. For any given number of sheets α is constant, and equal to 360 degrees divided by twice the number of sheets in the roof. The curve $D\,A\,E$ represents the intersection of the surface of the sphere with a plane $C\,A$, Fig. 2, passing through the center C, making a variable angle β with the vertical axis $O\,C$ and perpendicular to the center line $O\,A\,K$.

The main point in the problem is to find the variable angle ϕ in the moving plane $C\,A$, Fig. 2, which is included between the radii of the sphere and subtended by the arc $A\,B$. This angle, which is shown foreshortened in Fig. 3, varies in magnitude as the angle β is varied from 0 to 90 degrees by moving the point A from O to K.

We have first

$$O'\,A = R \sin.\ \beta.$$

R being the radius of the sphere. Pass a plane $H\,O'\,A$ parallel to the base of the hemisphere, the intersection of planes $C\,A$ and $H\,O'\,A$ being the straight line $B\,N$, Fig. 1. Next turn the plane $C\,R$ on $B\,N$ as an axis until it lies in the plane $H\,O'\,A$. The plan of this condition is represented by $C'\,B\,N$ and $O\,B\,N$, Fig. 1, in which

$$B\,C'\,A = \text{the true value of } \phi,$$
$$O'\,A = R \sin.\ \beta,$$
and $$C'\,A = R.$$

We have

$$\frac{B\,A}{O\,A} = \frac{B\,A}{R \sin.\ \beta} = \tan.\ \alpha\,;$$

whence, $$R \sin.\ \beta \tan.\ \alpha = B\,A.$$

Also, $$\frac{B\,A}{C'\,A} = \frac{B\,A}{R} = \tan.\ \phi\,;$$

whence, $$R \tan.\ \phi = B\,A,$$

and $$R \sin.\ \beta \tan.\ \alpha = R \tan.\ \phi,$$

or $$\sin.\ \beta \tan.\ \alpha = \tan.\ \phi. \qquad (1)$$

As α is known, we can by assuming successive values of β and using a table of natural sines and tangents, find corres-

ponding values of ϕ. In Fig. 4, which shows a development of a section of the roof, the value of x depends on the value of β, and

$$x = \frac{2\pi R\beta}{360} \qquad (2)$$

The value of y depends on ϕ, but since ϕ depends on β, y also depends on β, and

$$y = \frac{2\pi R\phi}{360} \qquad (3)$$

We have now determined three equations, (1), (2) and (3) between four variables, β, ϕ, x and y, in which x and y are the co-ordinates of points in the bounding curve of the roof sheet referred to a center line and a perpendicular at the vertex, the sheet being taken on the flat ready to lay out.

It should be noted that for a given roof the quantity $\frac{2\pi R}{360}$ is constant, and may be called C, and equations (2) and (3) may be written:

$$x = C\beta \qquad (2)$$
$$y = C\phi \qquad (3)$$

Furthermore, by assuming such values as 15, 30, 45, etc., for β the values of x become simple multiples of the first value. The necessary calculations for the layout of the sheet, as shown in Fig. 4, are worked out in detail below:

We first determine the constants C and tan. α. Assuming $R = 13$ inches, we have

$$\frac{2\pi R}{360} = \frac{2 \times 3.1416 \times 13}{360}$$
$$= .227''$$
$$= C$$

which is the length of an arc of 1 degree in a circle whose radius is 13 inches.

Assuming twelve sheets to the hemisphere,

$$\alpha = \frac{360^\circ}{24}$$
$$= 15^\circ$$

and tan. $\alpha = .268$.

Next assume for values of β 15, 30, 45, 60, 75 and 90 degrees. For the first value

$$\sin.\ \beta = .2588,$$

and from (1)

$$\sin.\ \beta \tan.\ \alpha = .2588 \times .268$$
$$= .06936$$
$$= \tan.\ \phi,$$

and $\phi = 3^\circ\ 58'$

$$= 3.967^\circ.$$

Since by (2) $x = C\beta$,

we have for the first value

$$x = .227 \times 15$$
$$= 3.4''$$

and since by (3) $y = C\phi$,

we have for the first value

$$y = 3.967 \times .227$$
$$= .9''$$

For additional values of x we double, treble and quadruple the first value, and for additional values of y we find new values of ϕ, and from them values of y. Tabulating the results, we have:

β	ϕ	x	y
15°	3.967°	3.4″	.9″
30	7.633	6.8	1.73
45	10.733	10.2	2.44
60	13.067	13.6	2.96
75	14.983	17.0	3.38
90	15.000	20.4	3.41

In laying out, we need only take the first value of x in the dividers, step off six spaces, erect perpendiculars, lay off the values of y above and below the center line and pass a curve through the points so found.

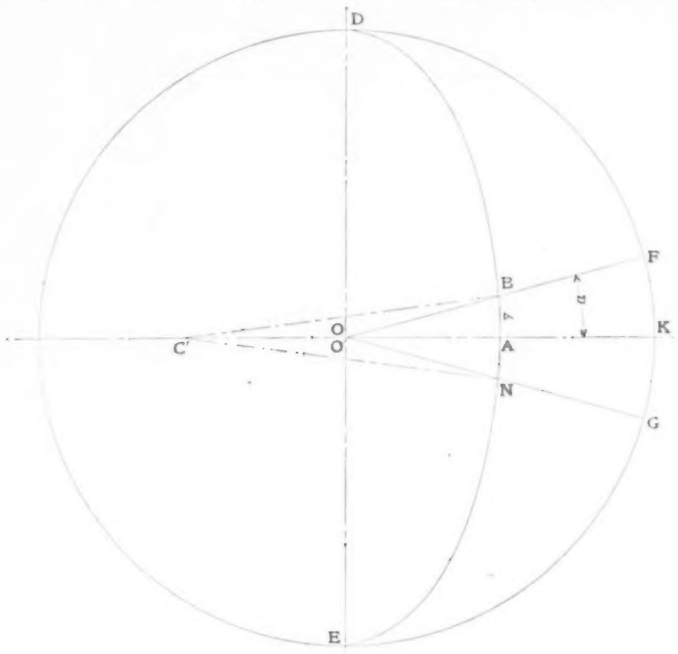


FIG. 1

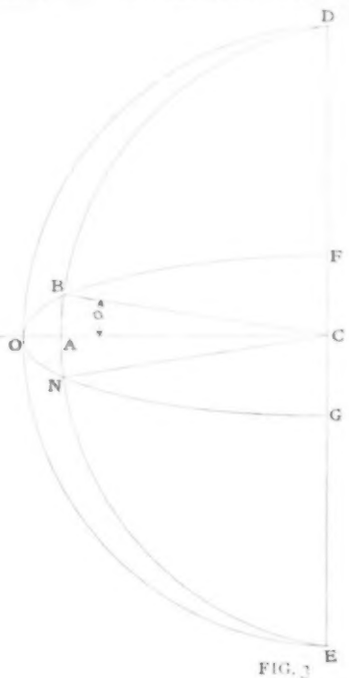


FIG. 3

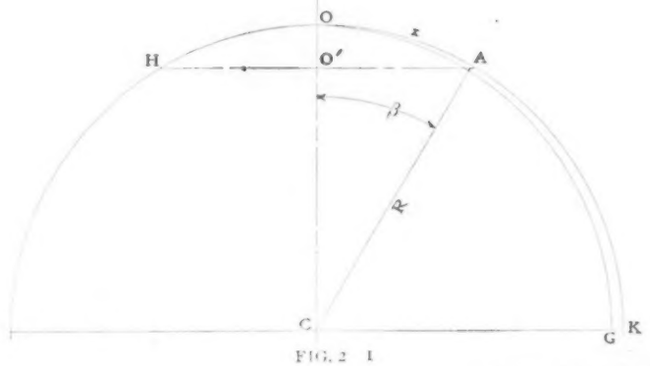


FIG. 2

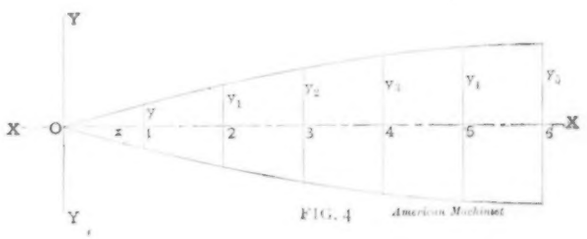


FIG. 4

LAYING OUT SPHERICAL ROOFS.

This method is correct and gives good results in practise. We used it on several roofs during the past winter. As the tangents of small angles are nearly proportional to the angles, we may, when α is small, multiply the angle in circular measure by the sine of β in order to obtain ϕ without serious error and thus shorten the work. We tried both methods on one roof, and using 11¼ degrees for α we found a difference of only 1-16 inch in the values of y, which for such work is of small importance.

The Value of the Chemist and Metallurgist to a Manufacturing Plant *

BY H. C. LOUDENBECK.

The value of a chemical laboratory in connection with a manufacturing plant depends largely upon intelligent supervision and the proper application of results. A laboratory may be properly equipped with all the necessary apparatus, may contain the most sensitive balances, may have the most expensive appliances known to the art, and yet fail utterly for lack of intelligent supervision.

The percentage composition of a steel is of no value unless we know its meaning, and the proper use is made of the knowledge. The analytical chemist, after much labor, may report a complete analysis of a sample of insulating material, but unless someone can interpret these results and can use them intelligently, they are without value.

The proper use of a chemical laboratory may be accomplished in either of two ways: First, by employing a practical chemist, one who has had experience in a manufacturing plant and has been in actual touch with the shop, and can put his chemical determinations to some use, or, in other words, make analyses that he can use. Second, by placing the laboratory under the direct supervision of one who can supervise and direct the work intelligently. No matter who has the direction, an outline of correct work toward beneficial results would be the same and would vary according to the kind of manufacturing carried on.

The education and training, as well as the practical experience of a man should be examined by the firm about to employ a chemist or metallurgist, for to be successful he must have both of these. It is desirable to have the college course followed by some experience in the laboratory where a variety of analytical work is performed, and to have the advice and counsel of experienced chemists, for accuracy and rapidity of the art can only be obtained in that way.

The experience necessary to successfully apply the laboratory results to a purpose is not easy to obtain, and is often gained at the expense of the employer. Here is a splendid opportunity for the technical schools to give the student some idea of how chemical and physical knowledge can be successfully applied to foundry practice. In this way the student will get practical advice from men who are experts and have learned from actual shop experience how to use theoretical training on the problems at hand.

The foundry is often part of a manufacturing plant, and when about to employ a metallurgist, his value to the plant as a whole should be considered. The tonnage from the plant may be too small, or the class of work too plain or unimportant to pay the extra expense of employing a chemist, but, when his value to other parts of the plant is considered, it may be that he is a paying proposition.

The following hints in regard to the practical application of the laboratory outside of the foundry proper may be beneficial. Chemical analysis as applied to iron and steel bought by a manufacturing concern. The tests should vary according to the use and grade of the steel. Often a soft open hearth steel is bought to be used in a forging machine where expensive dies are used. The percentage of carbon and phosphorus has a marked effect on the life of the dies and the quality of the forgings made. That is, the higher the percentage of these elements, the harder the steel and the greater the wear on the dies. It is therefore well to limit them and keep them as low as possible without materially increasing the cost of the steel. The cost factor should always be considered in a specification, but oftentimes an increased cost is justified by results.

A chemical specification, in fact any specification, should always be considered from the manufacturer's as well as the buyer's standpoint. A basic open hearth steel, on account of the low phosphorus, will often forge easier and the dies have greater life than acid open hearth or Bessemer having the same carbon content. For ordinary forgings, where expensive dies do not enter into the cost, Bessemer steel is suitable, limiting the phosphorus and sulfur to 0.10 and the carbon to 0.15.

The laboratory should be one of the means of testing the quality of a large portion of the material purchased, namely, pig iron, coke, copper, spelter, lead, varnish, oils, fiber, rubber, tool steel, pigments, etc. It is not the actual analyses that are of value; they are a means to a certain end. It is the advice to the purchasing agent and to the superintendent in regard to the purity and quality of the material that is of value.

The chemist should become familiar with the manufacturing process of not only his own plant, but also of the raw material his company buys. The question should not be so much, What is the analysis of the material? but Can we use it? A man thoroughly understanding chemical technology and practical physics can make himself very valuable by giving advice in regard to material purchased. Many plants melting only 15 or 20 tons of metal per day could well afford to employ a practical chemist, knowing that he would be useful to the plant outside of the foundry proper.

The value of the metallurgist in the foundry may be due to two factors: First, improvement in quality, and, second, reduction in cost. Making castings better—that is, free from porosity, stronger, easier to machine—will reduce loss and therefore reduce cost. A low cost in the mixture may mean an increased cost in the finished castings. It is largely a matter of good judgment, and the cost factor should be considered in all its phases. The object should be to use the cheapest mixture that will answer the purpose, and at the same time produce good results. This may be done by increasing the scrap, getting lower silicon irons and using job lots, too risky for the ordinary foundryman.

The metallurgist should become familiar with the analysis of all the brands of pig iron in the market, and by proper selection a saving of 25 to 50 cents a ton may often be made. If the iron is bought and placed in the yard without the laboratory as an aid, one of the greatest benefits of employing a chemist is lost.

Another factor may be mentioned. Iron in the yard should be used to the best advantage. A certain lot may be extra good, being low in sulfur and high in silicon and carbon. This should be mixed with scrap and gray forge in such a manner that the full benefit of the better grade will be realized. The ability of the metallurgist to make suitable mixtures is another valuable factor. A Western firm who make mining machinery had never been able to make stamp shoes that would give good service. The shoes were either too soft or the necks would break. The metallurgist was given the problem, and he made ten shoes, which were used in competition with others of noted makers at the Homestake mine, in South Dakota. The result proved them to be the best of the lot, and now the firm receives an order for 5,000 yearly.

Two things are essential in controlling foundry mixtures: First, to know the correct composition, and, second, to secure uniformity. The latter is the most difficult to maintain. Ninety per cent. of the castings may be satisfactory, but the 10 per cent. which are bad spoil the whole lot.

The utilization of the waste material may be considered the legitimate field for the practical chemist. Every manufacturing plant accumulates useless or unproductive material which is considered of no value. A man knowing the composition of this material and having a general knowledge of manufacturing processes may often suggest means of disposing of this waste at a profit. This may be done by using it in some process or selling to some firm that can use it. Every engineer should be saturated with the idea of using, not saving, all materials not considered of value. Germany leads us in this respect.

* Presented at the Indianapolis meeting, June, 1904, of the American Foundrymen's Association.

From coal tar we have acetanilid, phenol and the beautiful dyes. From blast furnace cinder, cement and mineral wool. Blast furnace gas is being used in the gas engine. The by-products are saved from coke-making, and alcohol is made from sawdust.

The importance of chemical technology in the development of our industries is not fully appreciated, and the greatest benefit from chemical knowledge obtained. The chemist should become more of an engineer, and the engineer should understand more of chemical principles. When our schools look to this, greater benefit will result.

An Emperor's Engineering Feat.

A new railway bridge across the Rhine has been opened by the Emperor William, which is regarded as a great triumph of German engineering.—*Canadian Engineer.*

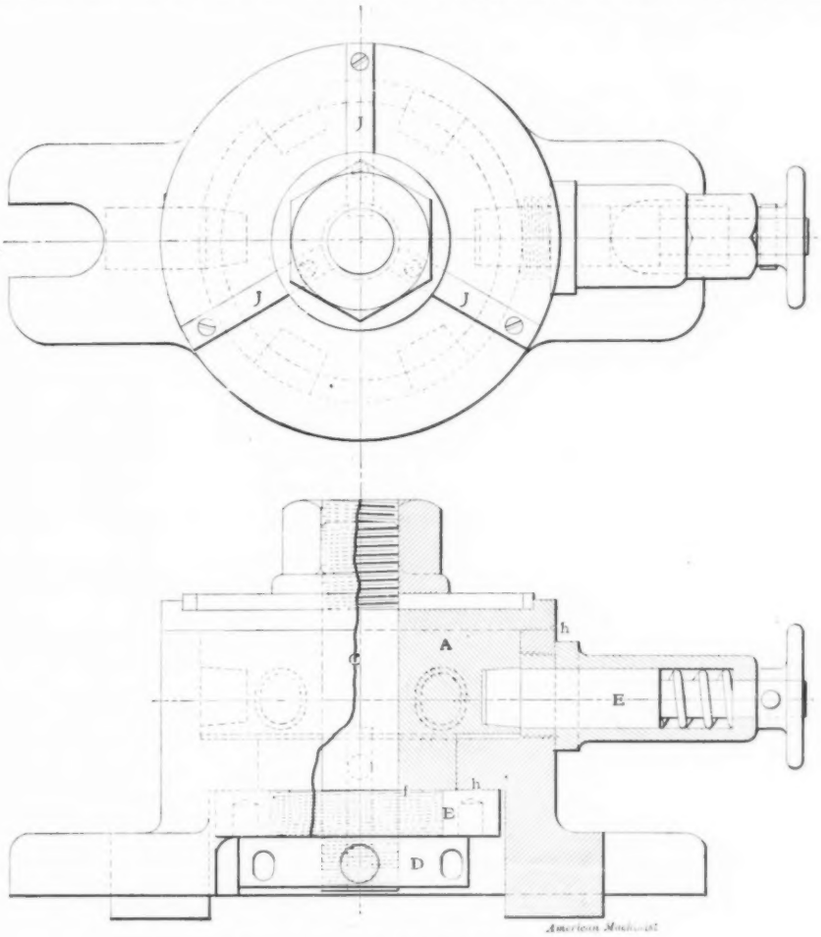
Back in the early days one manufacturer was asked to sell a machine to displace one of another make which was not doing good work. After looking over the mill he declined to sell his machine, and gave as his reason that the miller would throw out his machine in three months if he sold it, "because the machine didn't have any more brains than the miller."—*American Miller.*

Letters From Practical Men.

Milling Fixture for Hexagon Nuts.

Editor American Machinist:

The jig shown in the illustration was designed for the purpose of milling the flats of flanged hexagon nuts. The cylindrical part *A* is held in place in the base casting by the ring nut *B*, which is screwed tightly against the shoulder *f*, but between *h h* there is a "running" fit, allowing *A* to be revolved when not held in place by the spring plunger *E*, which fits any one of the six holes, 60 degrees apart on the periphery of *A*. These holes locate the faces of the hexagon nut to be milled.



MILLING FIXTURE FOR HEXAGON NUTS.

The arbor *C* is threaded at the upper end to fit the piece to be milled; the opposite end is threaded to fit the lock ring *D* and is also provided with a keyway fitting the pin in the lower part of *A;* this prevents the arbor from turning while screwing the nuts on and off.

The operation is as follows: The milling machine arbor is provided with a pair of facing cutters set apart a distance equal to the milled diameter of the nut. The piece to be milled, having been previously turned and threaded, is screwed on to the upper end of the arbor *C*, by means of a lever operating through the side of opening at the bottom of the base casting; the nut *D* is screwed tightly up against *B*, forcing the piece to be milled down firmly against the tool-steel jaws *J J J*, which gives it a three-point bearing and lessens the liability of chips getting between the surfaces in contact. After milling the first two sides the plunger is withdrawn, *A* is revolved until the plunger engages the next hole, and the piece is ready for milling the second pair of sides. Repeating these operations once more completes the nut. *D* is now loosened and the finished nut is readily removed. S. Bliss.

Squaring Numbers.

Editor American Machinist:

I have read with interest the various correspondence on squaring numbers, inasmuch as I have been in the habit of utilizing these and other simple "thumb" rules for rapid mental calculations for years.

I have little to add to the matter already published, but that little I believe is valuable, in that it presents the matter in a readily assimilative manner.

O. C. Bornholt (page 529), for instance, says "we can square a number ending with 5—for instance, to square 65 take 6 as the integer and treating the 5 as ½ we square 6 = 36 add 6, giving 42, and then annex ¼ (.25), which is the square of .5, giving $42.25 = 6.5^2$, and moving the decimal point $4225 = 65^2$."

Now, all this is more or less unintelligible or difficult to read, but had the subject matter of the letter been turned head before, commencing with whole numbers and finishing with decimal mixed numbers, the matter would have been much simplified from the reader's point of view. Apart from this, however, Mr. O. C. B. has overlooked a little point which would tend to greater ease of calculation.

Taking the example given, let me go through the mental processes which enable the result to be seen.

Wanted: $65^2 =$

Mentally I say: "Seven sixes, forty-two; twenty-five." Then on paper goes down 4225.

That's all, for I *know* that the squares of numbers ending in 5 end in 25.

Again, required: $125^2 =$

Mental process: Twelve thirteens, one hundred and fifty-six; two, five. Paper, 15625.

Rule then is: Multiply all the figures preceding the final 5 by those figures plus 1, then add at end 25, so:

9.5	10.5
$95^2 = 10.5$	$105^2 = 11.5$
90.25	110.25

Then if you want 9.5^2 or $.95^2$, all you need to do is to treat them as whole numbers and place a decimal point in the result.

$95^2 = 9025$	$105^2 = 11025$
$9.5^2 = 90.25$	$10.5^2 = 110.25$
$.95^2 = .9025$	$.105^2 = .011025$

Many numbers ending in 55 can also be readily calculated mentally.

Required: $1055^2 =$

First of all, we multiply 105 by 106 and add at end of result 25. This is not easily done mentally by the ordinary system of multiplication. However, $105 \times 106 = 105^2 + 105 = 11025 + 105 = 11130$ (the 105^2 being found by the rule already given). Now, add 25 after 11130, making it 1113025, which is the desired square of 1055. And now we also know 1.055^2, 10.55^2 and so on.

Again, many numbers ending thus can be squared, using paper and pencil as an aid to mental calculation, more readily by this method than by the ordinary rules of multiplication.

The chief point in this, however, as in other simple things, is to know when to use them, as more time may be lost searching out the solution than would allow the job to be done in the orthodox way.

Notwithstanding, a very little practise will enable one to judge on the spur of the moment as to whether the simple rule is available or not.

England. FRANCIS W. SHAW.

Repairing Experiences with Heavy Gearing.

Editor American Machinist:

Looking through an old note-book the other day, I noticed a sketch of the power transmission at the mill where I passed some of my days and nights as head repair man, and the thought came to me that possibly some of your readers might be interested in the troubles we had.

I had been at the place but a few weeks when the water-wheel tender telephoned to my house one noon that one arm of the big gear on the main shaft was broken. When I arrived at the mill I found that not one arm, but three were broken. The arrangement is shown in Fig. 1; it transmitted about 500 horse-power. The main or horizontal shaft was 12 inches diameter, speed 75 revolutions per minute. The flywheel weighed approximately 20,000 pounds, and was used solely as a balance wheel. Belt power was taken off the 84x18-inch pulley at the left, besides the power taken off by the two pinions. The big bevel gear was some 90 inches diameter, 5 inches pitch, 14 inches face, while the pinion was about 40 inches diameter.

One arm of the gear was broken completely off, the crack being open about 3-32 inch, as shown in Fig. 2. It was an ordinary heavy gray-iron bevel gear comparatively new, and the break was evidently due to strains in cooling. The arms next to the broken one, and on each side of it, were also broken or cracked, as shown at Fig. 3. Numerous repair schemes were proposed, but it was decided that the risk was too great, so the mill was shut down for a week while the new gear was being made. This was merely a reproduction of the first one, as the people who made it said it was "according to rule, and therefore all right," etc.

As I was a new man, the superintendent decided to have an expert mechanic from the foundry come down to take out the old gear and put in the new one. This man had put in the first gear, and, as we expected a guarantee on the new one, this seemed like a reasonable arrangement. We had no machine shop facilities for handling work of this size, so the gear and shaft were loaded on a wagon and hauled to the shop of the foundry company for all the machine work.

To get this length of shaft out, it was necessary to take the 84-inch pulley off, and to lower the bottom half of the flywheel down into the wheel-pit. We had three chain hoists, one of 8,000 pounds and two of 4,000 pounds capacity. The big one and one of the small ones were hooked on to the top half of the flywheel, the big hoist taking the weight and the small one dragging it off the coupling so that the bolts could be taken out. The wheel was shored up and lashed to the timber overhead. About one-third of the coupling bolts could be taken out, after which the water wheel could be turned by carefully applying the water and some more bolts were removed. The shaft and gear could then be hoisted out and rolled on timbers placed on oil barrels to a convenient place for loading on a wagon.

It was less than six months before we had a chance to make another try at the same job. This time we knew more about the accident, for the attendant was near the gear and heard a distinct snap, and shutting down he found the arm with a brand new break clear across it exactly as before. We insisted on a change of pattern for this gear, and Fig. 4 shows it as made this time, the hub being split, to relieve the strain on the arms, and then bolted together with four 3-inch bolts. Owing to the location of the bearing, it was impossible to drive the keys from the back side, and, as I was very much afraid that the gear would slip back, I took particular pains to prevent such a contingency. Before this the gears had been forced on by hydraulic pressure, so the direction of driving the keys made very little difference, as they were merely a precaution. I found a big open-ended wrench some 3 feet long that needed only a slight alteration to fit the bolts in the gear. This wrench had a ring in the end, and by hooking a light tackle into this ring we were able to put a considerable strain on the bolts. Anyway, we pulled until we opened the jaws. It will be noticed in Fig. 4 that both the keys are in one-half of the gear. We tapped one key in lightly, then the other, following up first on one, then on the other, finally driving them home with a heavy sledge until they "sung." I may say that the gear never moved.

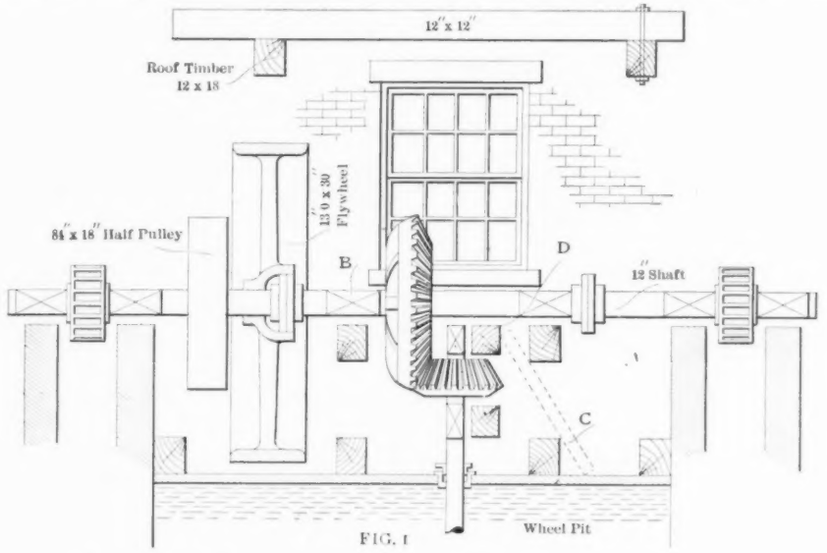


FIG. 1

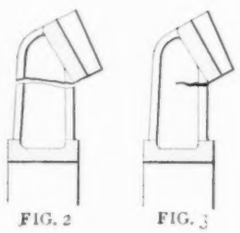


FIG. 2

FIG. 3

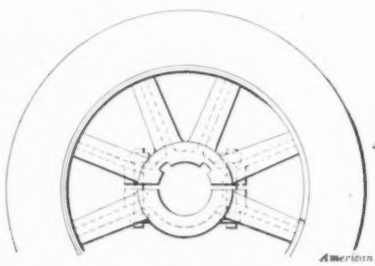


FIG. 4

FIG. 5

REPAIRING EXPERIENCES WITH HEAVY GEARING.

About a week later one of the teeth in the pinion turned up missing. It must have been an old break, for about 60 per cent. of the fracture showed black oil of no recent date. This calamity was discovered at noon, and we immediately set out to repair the pinion. The first thing was a telephone order for a new pinion, next a visit to the blacksmith shop to order three forgings for pins. We then

fastened a 4x4-inch scantling, as shown in dotted lines at C, Fig. 1, and proceeded to ratchet in three holes. The head room for this job was so limited that it was a most tedious job. As one of the men put it: "It was like working under the bench." By the time these holes were tapped, the shanks of the pins were turned and threaded. The pins were then screwed into the gear, and the gear was chipped to bring the pins to a firm seat, and in line.

But the worst was yet to come. I measured down on one of the whole teeth and made a tin templet for each end of each pin, copying the business side of the tooth as accurately as I could, but paying very little attention to the back side. The pins were worked out in the shaper and a hole was drilled in the shank. Fig. 5 shows the pins in place, and the means taken to prevent their unscrewing. The whole job was finished at 6.45 the following morning, just fifteen minutes before time for the mill to start. This repair job ran without any incident for ten days, sixteen hours per day, at the end of which time they showed a fine tooth contact along the entire length of the pins.

The first Saturday after the new pinion arrived we shut down at 5 o'clock and stripped off the flywheel and gear, taking up the timber *D*, Fig. 1, to get at the pinion. If we had had a hydraulic jack to pull the pinion off with it would have been an easy matter, but unfortunately we had nothing but the chain hoists and the big sledge. We hooked the three chain hoists into the pinion and set up good and snug. Then putting a chunk of soft brass on the top of the shaft, we came down on it with the 30-pound sledge. It moved a little at each stroke, but it was such a very little. As a man could strike but a few blows, we all took turns, and for four hours we hammered on the end of that miserable shaft. From time to time we set up on the chain hoists, and as we straightened out the hook on one of the 4,000-pound hoists we must have at least taken the kinks out of the chain. These hoists certainly did double duty that night.

Sunday morning dawned and the gear was off, but the shaft had to be draw-filed, as the new gear was bored a trifle small. The machinist gang came on at 7 and fitted the key, and by 3 that afternoon the gear was on and the big gear back in place. The gears did not mesh exactly right, and it was necessary to shift the big gear. We did such a good job the other time putting it on that we could not get it loose, now that we wanted to. We could neither get in at the back end with a drift nor could we slacken the nuts. The millwright finally got one nut loose by beating on it with a hand hammer, after which the rest was easy.

Before coupling up we turned the water on to make sure that all was right, but not a wink did she budge. The water was shut off and a visit was paid to the wheel-pit. Nothing seemed out of place, and the only things that we could find wrong were some round twigs, say ¾ inch in diameter, wound around inside the gate. The wheel had a stiffening ring with a beveled edge on top. The end of a twig was wedged in the opening, and we had lifted so hard on the wheel that the jam was tight enough to hold the wheel. We chiseled out what we could, turned on the water and tried again, with the same results as before.

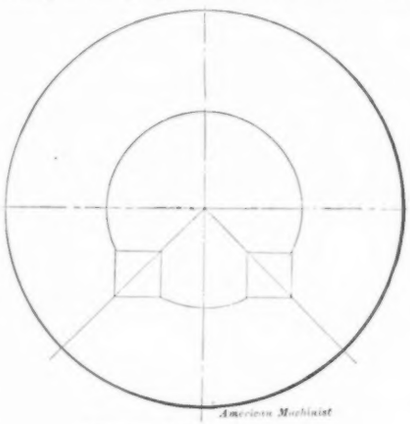
We took a big iron bar and got a pry in the end of one of the teeth on the big gear, and turning on a full gate we had the satisfaction of seeing the wheel almost jump to full speed, and it certainly was a beautiful sight, to me at least. It remained only to couple up and put everything back in place, and 4 o'clock Monday morning saw the mill running, and I was glad enough to turn in. We never had any further trouble with the outfit during the time I remained at this plant, so it never again fell to my lot to dismember this machinery. R. P. KING.

Indianapolis, Ind.

Keying Hubs on Shafts

Editor American Machinist:

If there is anyone who has a good word to say for keying hubs on to shafts in the



KEYING HUBS ON SHAFTS.

manner shown by the sketch herewith, I would be pleased to know what their talking points are. J. C. MATHER.

Cost of Draftsmen's Kits—Over-exposed Blueprints.

Editor American Machinist:

I wonder that it does not strike the draftsman that the total value of his kit, if he goes in for such articles as Brown & Sharpe's protractor, steel scales, adjustable angles, etc., is likely to assume such proportions that it may far exceed the cost of a universal drafting machine. This always strikes me when I hear these first-referred-to things mentioned—as at page 526.

If a blueprint of the extra rapid type has been over exposed, just put it in a dark drawer and leave it for a day or more, then wash it and you will have a perfect print with an exceedingly dark ground, the lines being white as whiteness. Our blueprint boy is a careless ass, and often leaves a print exposed for hours. One day, the boss happening by, he thrust one of his wasters into a drawer and straightway forgot it. A day or two after, he discovered it and, noticing its appearance of correct exposure, washed it "on spec." Result: If a blueprint isn't wanted in a hurry, he over-exposes it purposely and adopts the proceeding mentioned.

England. D. E. SIGNER.

Different Methods of Making Working Drawings.

Editor American Machinist:

I have seen about half a dozen different ways—American, German and English. I wish to draw your attention to the five most common.

No. 1. The commencement is made by drawing the machine out in pencil on a mounted sheet of paper. Ink in, color and dimension. This is given two coats of varnish and sent into the shop.

No. 2. Instead of inking the above drawing in, a cloth tracing is made in ink and dimensioned. The coloring being done on the opposite side, one coat of varnish is applied to back and two on the front. This is tacked on a roller and sent into the shop.

No. 3. This is similar to No. 2, but instead of varnishing the tracing a ferro-prussiate print is taken. This is varnished and sent into the shop, tacked on a board.

No. 4. Every part of the machine is drawn out separately, to a large scale, such as main casting, brackets, wheels, etc. These are traced, blueprints taken, mounted on cardboard and sent into the shop. A general arrangement drawing is generally sent into the erecting department.

No. 5. Instead of ferro-prussiate prints, ferro-gallic (black line) prints are taken. These prints are colored, varnished, mounted on linen, tacked on a board and are then ready for the workmen. The tracings are not colored in this case.

In all the above five ways a detail is generally made for the forgings, drawn and inked in on a mounted sheet of paper, lined in red for machining. This is varnished and mounted on a board, no record being required.

No. 1 is the old style. Many English firms still keep to this practise. "It did for grandpa; it will do for me." The first and second amount to this: You have only one copy of the dimensioned drawing, which is very inconvenient. Perhaps you will send this drawing into the shop before the remaining drawings have been completed. This means valuable time being wasted carrying the drawing from one department to the other. Perhaps the patternmaker, the erector and the draftsman all require the drawing at the same time, which is often the case when a machine has to be out in no time.

The third, fourth and fifth ways are a great improvement. In the drawing office

you always have the tracing as a record. Perhaps the foreman in the shop does not understand the drawing properly; all he has to do is to slip into the drawing office and we have the tracing ready for him to refer to. Thus the workman loses no time in not having the drawing.

Take No. 3. When you have a complicated motion it is hard to make plain on a blueprint, the fifth way has the advantage here; you can read it quite easily, the different colors showing the different materials quite distinctly.

The fourth method is a good one, though it is rather an expensive item for the drawing office. Every part to be drawn out separately takes time and several sheets of paper. The patterns are certainly made quicker, but the patternmaker generally likes to see whether he is making a gas engine or a motor car.

I think the fifth way is the best. With the modern electric light printing apparatus, copies may be had in a few minutes.

Tracing is a great advantage. You can trace three or four different views, such as outside view, one or two sections, all from the same drawing by simply moving the cloth. When you draw everything on one view you can see better if everything is clear. The alternate way, you draw first outside view, then a section here and one there. When you have finished the drawing, and the machine is made, you find a lever drawn in one view collides with a wheel in the other view.

There is one disadvantage in the last three ways. You have two drawings to alter when you make a mistake (the print and the tracing); but this makes the draftsman more careful. Black prints are far easier to alter than blue ones. Black prints are very handy in case of tender drawings. Supposing a tender has been given you for a planing machine; you find a paper tracing of a planer just the right capacity. The only difference is it has to be motor driven, and pulleys are shown on the tracing. All that is required is to take two black line prints, wash the pulleys out with acid or erase with sandpaper and draw the motor on in ink, make the two prints agree, keep one print in the office as a record. I have seen all this done in about three hours, where it would have taken two days to trace.

In making working drawings, they should be readable, one view projected from the other wherever possible. I think there should be no hard and fast rules; such as if a part is not cut, it must not be sectioned. I have often made drawings showing all the dotted work for unseen parts. When I have received the print I have colored it just as if it had been a section. I have written under the view, "Coloring shows section on *A B*." I have not known any error by so doing. Otherwise I would have had to make an outside view and a sectional view.

I also find half-size drawings are strictly prohibited in England. I think this is a mistake. From quarter scale to full size is a great step. Years ago dimensions were not even put on the drawings. The half size might cause trouble, but now when all the dimensions are given it is hard to get wrong, unless you are very careless.

B. G.

L——, England.

An Old Man for an Air Drill.

Editor American Machinist:

Fig. 1 shows an old man in position on top of boiler, ready to receive air drill. The bottom plate, Fig. 2, is a piece of ½-inch boiler plate drilled and tapped as shown. The four ⅝-inch tap holes are for the rods, four of which are used (see Fig. 5); the short threaded end of these is screwed tight into the bottom plate and then riveted over on the under side of the plate; this plate is given the radius of an average locomotive boiler. The top plate, Fig. 3, of ¼-inch boiler plate, has four ¾-inch holes drilled in it, which fit over the four ⅝-inch cold-rolled rods and is held at suitable hight by means of nuts top and bottom. The old man is held securely in position by means of the chain, gripe and turnbuckle which encircle the boiler. It will be seen that there are four ¾-inch set-screws in the bottom plate, which adjust the old man to any irregularities in the surface of the boiler. In order to move the old man from place to place in a boiler, it is necessary to slack up a few turns on the turnbuckle, when the whole thing can be slid to the required position.

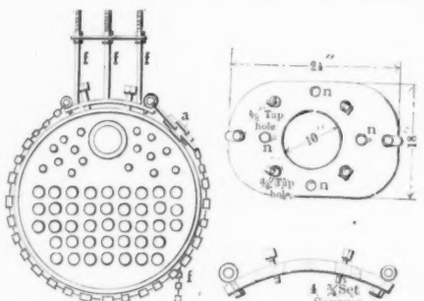


FIG. 1 FIG. 2 Bottom Plate 1 of ½ Boiler Plate

AN OLD MAN FOR AN AIR DRILL.

S. E. L.

[We don't see the necessity of curving the bottom plate; the set-screws would take care of the curvature of the boiler.—Ed.]

Savings With High-Speed Steels.

Editor American Machinist:

Why should there be so much guesswork when a few hours, sometimes a few minutes, of stop-watch observations will give unimpeachable records? Opinions are worthless: I have gone to sensible men, asked them about matters within their daily experience, and had them estimate 3,000 as against the reality of 20. In fact, on this particular question, I consider a man's judgment remarkably good who comes within 100 per cent. of the truth.

W. Osborne, whose echoes I read with extreme interest, tells what foremen and draftsmen *think* about cutting times; but what is wanted is records.

The actual cutting time is a much smaller proportion of the whole than is generally imagined, and the economies of time to be effected by cutting out other wastes far surpass those realizable by high-speed steels. These latter have merely emphasized the possibility of time economy.

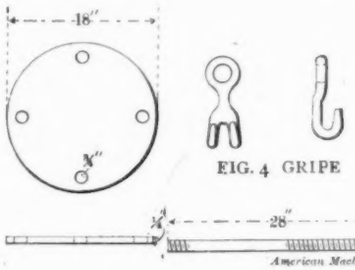


FIG. 4 GRIPE

FIG. 3. TOP PLATE. FIG. 5. ROD.

As a sample of the results obtainable by time study, I submit the following: A big machine shop had a large order for planed gray-iron slabs, which were being done eight at a time on the biggest planer. The time averaged 40 hours for a set of eight. The time was reduced to 20 hours, and on one set to 18 hours 30 minutes. On these fast records, the planer was actually moving 7 hours, and the high-speed steel was cutting close to 3½ hours. Could we have eliminated the whole of the cutting time, we could have saved only about 16 per cent. The actual reduction of the time to 50 per cent. of what it had been was secured by something else than high-speed steel.

When the job was first taken hold of, each heavy piece was put on and taken off by hand labor, slow and laborious; they were set up and lined up in a painstaking and slow manner, and the planer was constantly stopping because a 15 horse-power motor that allowed only small feeds and low speeds, did not give power enough.

An overhead I-beam with chain block on it expeditiously put on and moved the heavy pieces; jigs and special dogs permitted the work to be set up quickly and accurately; a 40 horse-power motor permitted the planer to move steadily, reliably and rapidly at highest speeds and with maximum cuts. The softening of the iron by attention to foundry conditions helped matters also.

With carbon steel alone the job could have been brought down to 24 hours from 40, and without high-speed steel the time could probably have been ultimately cut to 12 hours, by still better facilities for handling and setting up.

High-speed steels are an important item, but only one out of many more important in the machine shop. As Mr. Osborne justly suggests, there is more chance to win 75 cents from a crowd with several dollars in their possession than to capture

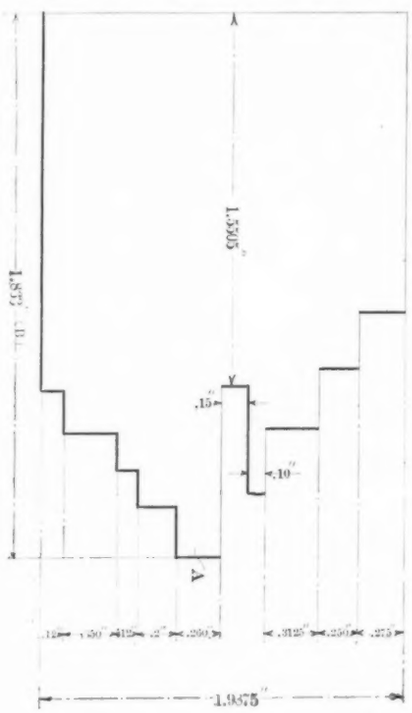
25 cents from the fellow who owns only 15. Take 10 out of 15 by all means, but do not overlook the balance of the crowd.

HARRINGTON EMERSON.

Suggestions for Draftsmen—Dimensions on Drawings.

Editor American Machinist:

I notice the draftsmen are discussing the manner in which scales should be



PLACING DIMENSIONS ON DRAWINGS.

graduated, held when in use, etc., and it leads me to offer a few suggestions to the draftsmen which, if heeded, will be greatly appreciated by those who are obliged to fathom the drawings.

It seems to be a universal custom among draftsmen to place dimensions where they will add to the appearance of the drawing, and the dimensions are invariably given from points that the machinist would never think of working from. For instance, by referring to sketch we note that the dimension *B* over all is 1.863 inches and the distance from end to bottom of slot is 1.5505 inches. Now, when the toolmaker is making the piece shown in the sketch, he is obliged to measure from the edge *A* to the bottom of the slot. But, in order to ascertain the depth of the slot he is obliged to subtract 1.5505 inches from 1.863 inches. Again, by referring to the sketch we note a series of detail dimensions and also a dimension over all. But in order to ascertain the distance from edge of slot to outside edge the machinist takes his pencil and adds a number of dimensions together. Should the machinist make a mistake in compiling the figures and spoil the job, the machinist is blamed and not the draftsmen—who are paid for figuring.

Drawing rooms are not maintained for the production of show-case work, but to convey the idea intelligently to the workman, and when the patternmaker is obliged to take paper and pencil and do a lot of figuring in order to obtain figures to work from and the machinist hunts up his stub of a pencil and finally arrives at a working figure and the toolmaker goes through the same "rigmarole" I claim it is wrong. There are too many chances for errors, besides the dimensions could and should be properly placed on drawing by those who are employed for that purpose. When employed at drafting I pay particular attention to placing the dimensions so that the workman can measure from the working end of the piece without compiling a number of figures.

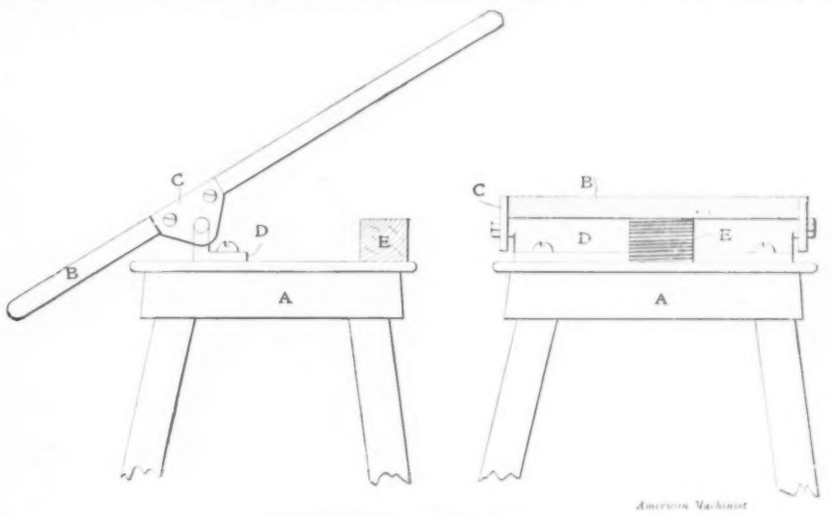
X. MACHINIST.

Tilting Seat for Draftsmen.

Editor American Machinist:

The fixed drawing-board is primitive but is still very generally used and if a draftsman cannot prevail upon his employer to supply him with a more modern adjustable article he may find the following idea, of a tilting seat for his stool, of value.

A stool may be of the right hight for a man when working, say, in the middle of the board, but will possibly cause much discomfort and indigestion when he is working at the lower or upper edge of the board. The tilting seat addition to a stool, as shown in sketch, overcomes this trouble and has turned out to be exceedingly comfortable. It should be arranged so that when flat it allows the man to work in comfort at the bottom of the board; if he straightens his legs slightly the board is tilted and his body is thrown upward and forward for work at the middle of the board; then, if he further straightens his legs, tilting the board to about 45 degrees, he can comfortably reach the upper edge of the board.



TILTING SEAT FOR DRAFTSMEN.

In the sketch, *A* is an ordinary stool, *B* a tilting board with side plates *C*, *D* a piece of angle iron with ends filed for holes in plates, *E* a stop for the "flat" position of the board. Try the principle with a book balanced on the edge of a stool.

R. D. S.

Birmingham, England.

Another Set of Draftsmen's Scales.

Editor American Machinist:

I have read with considerable interest the different descriptions of draftsmen's scales that have lately appeared, and as my outfit has been collected from wheel pit and fireroom to drawing-room, it is a little different from what is usually found on the drawing-room tables.

In connection with the usual triangular boxwood rule I have a 35-cent 2-foot rule, also a 4-inch and a 6-inch steel rule, a 2-inch thin steel square, the blades of which are ½-inch wide; besides a folding rule, same as was illustrated at page 632. This rule is graduated to millimeters on one side and to inches on the other side, and if there is any translating of measurements to be done I use this rule. I also keep in mind that 25 millimeters plus 1-64 inch are equal to 1 inch, nearly.

For short measurements I find the thin square to be the most used. Not only is it a square, but it is a 45-degree angle as well. Besides using the graduations, I also use it as a limit or end measure gage. Suppose I had to draw a ½-inch shaft or hole, I would place the blade, which is ½ inch wide, against the T-square or angle, letting the mark ¼ inch from the end match the center line on the drawing, then draw a line on top edge of the steel square, then slide it out of the way and draw the second line against the blade of the T-square; or if the shaft or hole is to be 1 inch, I place the top edge of the T-square on the center line and then add the ½-inch width of the square, and then drop down ½ inch and get the lower line. The same is also true of 2-inch measures. While it is not a universal affair I use it more than all the others combined. As yet no one has condemned it, and several seemed pleased with its use.

I have also a steel triangular rule, and altho it is excellent to slide a pin-point down the graduations, I seldom use it for that purpose, altho the different graduations come very handy at times.

G. SCHNEIDER.

Hoisting and Lowering Shafting With a Rope.

Editor American Machinist:

Mr. Brady's article, "An Improvised Hoist," at page 527, was, so far as it went, interesting and practical; but when

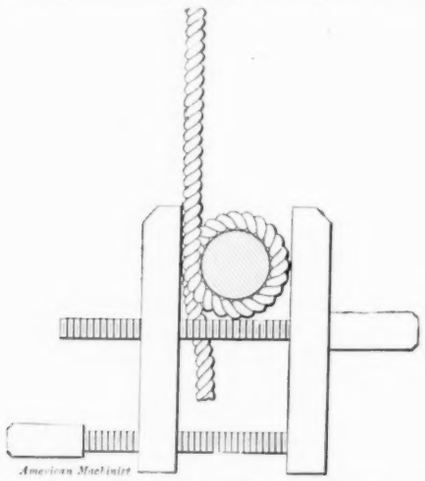


FIG. 1. CLAMPING A ROPE SUSPENDING A SHAFT.

brother D. W. Rogers comes in, at page 691, with improvements I would draw his attention to some more improvements and venture some well meant criticism.

First, it is our invariable rule when hoisting anything in any way to keep all

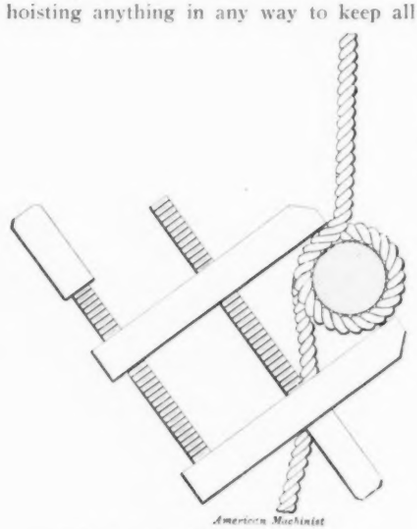


FIG. 2. THE PROBABLE RESULT.

hands out from under rather than to place them there, and to use as few men as possible, both on account of economy and because too many cooks spoil the soup.

Mr. Rogers claims that the main beauty of his way lies in that a rest may be had at any time by simply clamping the *rope* to the *shaft*. Did he so rest in his one-ton lift, and how did he fasten the rope and shaft? Fig. 1 shows the only way I can think of. The immediate result of letting go would be as shown by Fig. 2. I very much doubt whether a wood clamp is made that could withstand the peculiar pull and push here shown and when exerted by a one-ton weight.

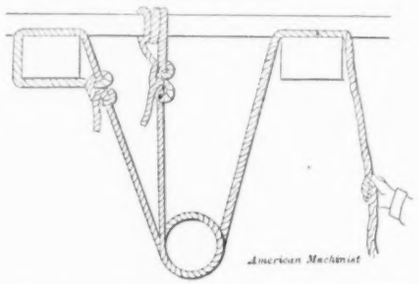


FIG. 3. LOWERING WITH A SAFETY ROPE ADDED.

We are specially warned that great care must be used in tying the loose rope's end into the standing rope above the shaft if that method is used for a rest. The loosening of the loops, we are told, will bring the whole shooting match down with a rush. How about the accidental slipping of one of the men, a ladder or rope? One ton falling with a revolving and accelerating motion with two men on ladders and two on the floor involves a rather serious risk.

It would be better for brother Rogers to use the method shown in Fig. 3 next time. It has economy, ease, and constant safety to recommend it. If there is only one pulley on the shaft, two safety lines may be used, one at each end, and the rolling hoist rope in the middle.

If the piece to be hoisted is exceptionally heavy and lacking a pulley large enough to serve as a hoist lever, any bar or piece of timber may be used as shown by Fig. 4. If the center hoist and two-end safety-line way is used, with a bar or even a pulley, try to make it work centrally, as shown by Fig. 5.

Where an extra large and heavy pulley countershaft is to be hung on a very high

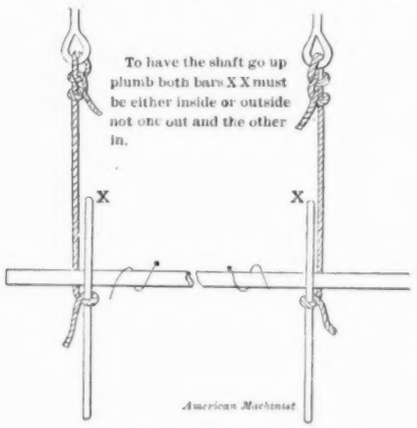

To have the shaft go up plumb both bars X X must be either inside or outside not one out and the other in.
X
X
American Machinist

FIG. 4. HOISTING WITH TWO ROPES.

ceiling and rolling must be resorted to, for lack of head room or suitable tackle, the inadvisable, because most hazardous, rolling from ladders can be done away with as in Fig. 6. The hangers being up, place the stripped shaft in the bearings and adjust the collars. Tie a rope's end to the pulley on the floor, pass the other end over the shaft, run a bar through a bow-line in the rope and hoist the pulley to the staging from which the counter was put up. When everything is on the scaffold take the shaft out, assemble the counter and hoist it into place the rest of the way in the regular manner.

CHAS. HERRMAN.

Filing Catalogs.

Editor American Machinist:

Here is a method of filing catalogs that has so far successfully met all demands

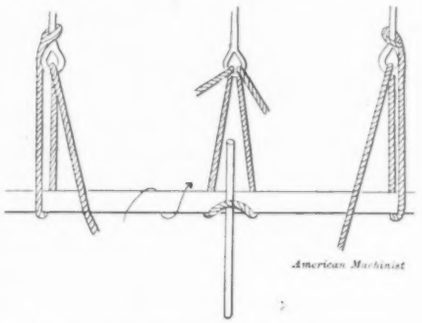


FIG. 5. ONE HOIST AND TWO SAFETIES.

made upon it. The vertical filing system is used for all catalogs except large ones bound as books. Each catalog when received is given the next consecutive number and card indexed under "subject" and "firm's name." Each catalog less than ⅜ inch thick is stripped of its cover and all paging in front of the title page. It is then stapled to one edge of a heavy card, cut to easily fit the drawer of the vertical file; the cards in this case being 9¼x11½ inches. All folders and loose sheets are treated in the same way, two or three

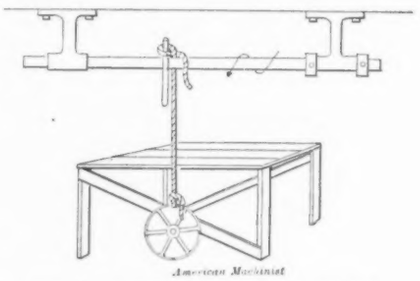


FIG. 6. HOISTING WITH A SCAFFOLD.

small catalogs on the same subject being stapled to one card. Large page catalogs are folded twice and some thrice, a heavy letter press being of some assistance for this purpose. In one or two cases a catalog failing to yield to this treatment was brought into shape under a 30-ton hydraulic press.

Catalogs thicker than ⅜ inch are numbered on back edge and placed in their proper place in the file, the adjacent cards being sufficient guides. The thickness, ⅜ inch, is merely arbitrary, that being the capacity of the stapling machine and also the size of the figure on the numbering hand stamp. Bound catalogs larger than

9x11, or too thick to yield to the folding operation, are filed on shelves, two hundred numbers being reserved for them, the file proper beginning with 201.

Standard sizes are very desirable, but at the present time there are too many valuable catalogs of odd size to justify a selection based only on size and shape. With the above method of filing, the 9x20, the 3x10, or the little 3¼x6 end-opening envelope folder are all equally welcome and are filed with little difficulty.

"Artistic advertising" has become epidemic and is responsible for the many freak catalogs issued. At the present time most concerns seem quite at the mercy of the modern "ad" writer. These facts are very evident to the humble seeker after "catalog wisdom," who, before he files his catalog, must first get it.

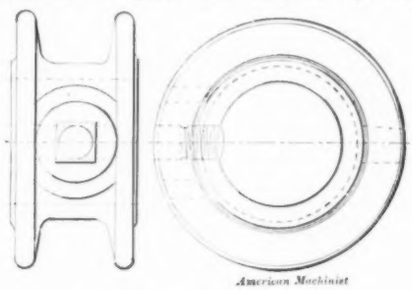
Now the simplest way to get a catalog is to write one's name and address on the margin of the page containing the advertisement, tear out the page and mail to the concern interested. This usually brings the desired literature and has the merit of taking very little time, showing as well where the advertisement was seen.

X. DRAFTSMAN.

A Safety Shafting Collar.

Editor American Machinist:

The illustration shows a shafting collar recently designed and adopted by the



A SAFETY SHAFTING COLLAR.

Whitcomb Manufacturing Company. While the collar may not be entirely new, I have not seen elsewhere the circular case around the set-screw or the bar across the opposite side, both of which serve to make the collar danger proof. C. M. C.

Simplified Spelling—Time Wasted in Drawing Details—Lettering Drawings—Drawing Ink—Scales—Tracing Cloth Window Shades.

Editor American Machinist:

"The spirit moves," and after a silence which has perhaps been enjoyed I again address the brethren. I hope the conscience of our old friend Tecumseh Swift has not been troubling him on account of his little fling at what he called an editorial pat on my back. I didn't keep mum so long for that, but just because I had nothing to say worth saying. I notice Tecumseh himself has these silent spells, possibly for the same reason.

I believe I discovered not long ago in the AMERICAN MACHINIST something which marks an epoch in human progress. It was placed inconspicuously, and some may have passed it by unthinking, but when a journal of the standing of sajd AMERICAN MACHINIST boldly writes "diafram" for "diaphragm" it is worth notice. If we are to have fair play for the lesser known mechanical movements, let us also have fair play for the medium through which we are to make them more widely known. Why not admit that we speak and write one of the most absurdly and abominably constructed languages ever known and take all the benefit we can from modern improvements in it? Why do we pass over mistakes in grammar, or an almost criminal lack of geography and history, to rise and howl if someone drops a jag of silent letters from an overburdened word? It isn't consistent and it isn't fair. Let the good work go on.

Then, too, Mr. R. P. King actually dared to suggest that absolute accuracy was not the first and only consideration aimed at in section lining, tho with fear and trembling lest he be called a heretic for so doing. Such things give hope that in time draftsmen may realize, while planning all sorts of innovations for the shop, that charity begins at home. Was the most hidebound stickler for precedent among our British cousins ever more wedded to old and worn-out ideas of shop practise than we are to similar ideas of drafting-room practise?

An architect doesn't shingle and clapboard his whole house on paper, and a monumental draftsman would be fired if he wasted his time in repeating the design of a carving its full length unless the drawing was for photographic reproduction. Why, then, should a mechanical draftsman feel in duty bound to string threads the entire length of a screw, show every one of 229 flues in a boiler head or cross-section every inch of sectional surface shown? Just precedent, beloved, nothing else.

When we have confidence in a merchant we are willing to buy his goods from samples, and when a small object is to be repeated by hundreds in a drawing a sample or two should suffice. Doubtless a drawing could be so made that nothing but the dimensions would be needed to have it tell its story in unmistakable language, but is it worth while when a few well-chosen sentences written in give the same result in a fraction of the time? Plain English written in a plain hand can be made very effective on a shop drawing, and it is not used as freely as it should be.

Then take the matter of lettering drawings. When metallic types were invented the so-called Roman letters finally became the standard, and doubtless for some good reason, but they are exceedingly ill-adapted to hand manufacture, and the Egyptian and block styles are not much better. Not one draftsman in a dozen can do a decent job with the first two mentioned and the third takes a lot of time. If a man can handle one of the many free-hand alphabets acceptably, or even write a good hand, the time spent in putting block letters on shop drawings would be better used in making threes and fives and eights which cannot possibly be confused, even if a fly did roost over one while it was blueprinting. If a man feels that his drawings must be lettered as his grandfather's were, let him invest in an adjustable rubber stamp and some opaque ink.

Mr. Mittendorf says truly that Higgins' waterproof black ink lacks density, and he might have added that what density it has is sensibly reduced by even the softest of pencil erasers in cleaning a drawing or tracing; but what are we going to do about it? The general black is out of the question for most work on account of its "smoochiness," and of the other makes which I have tried those few which had greater density gummed the pens like varnish.

Some time ago I tried a stylographic pen for pencil sketching—if that is not a bull—and now use it almost exclusively for such work. It handles in much the same way as a pencil and the resultant sketch yields a very fair blueprint from thin paper. This is a great help in getting details into the shop with a rush order, and it removes all possibility of monkeying with pencilled dimensions, which has been known to happen. With the aid of cross-section paper quite a complicated sketch is quickly gotten out and into the shop.

Speaking of scales, it seems to me it is largely a matter of personal fancy and more so of long familiarity. When a man has used one kind for many years, a really better one might prove only a nuisance to him. I once had a tubular brass triangular scale made to order and finished in dull nickel, but I soon turned it over to the bookkeeping department. I learned to work with paper scales having the fine graduations running the entire working length. After a while I had some white edged flat boxwood scales made on the same plan, and I got so accustomed to these I was not able to make any sort of headway with the Universal drafting machine until I had it fitted with six special scales. After I got those I found I could turn off work with a neatness and despatch not known before and also with much less effort.

While the machine referred to is well named, I still find both the 3- and 6-inch 45-degree celluloid triangles very useful adjuncts. With the latter I can cover a surprisingly large board with the small-sized machine, and with the former short lines like screw threads are drawn more quickly than with the machine alone, while both are useful in inking, as one can travel about the board to fill in odd lines with much less danger of getting into undried ink. I wonder why the sheet of instructions which accompanies the machine says nothing about putting the inking edge into the vertical arm. I find it much handier than in the horizontal arm.

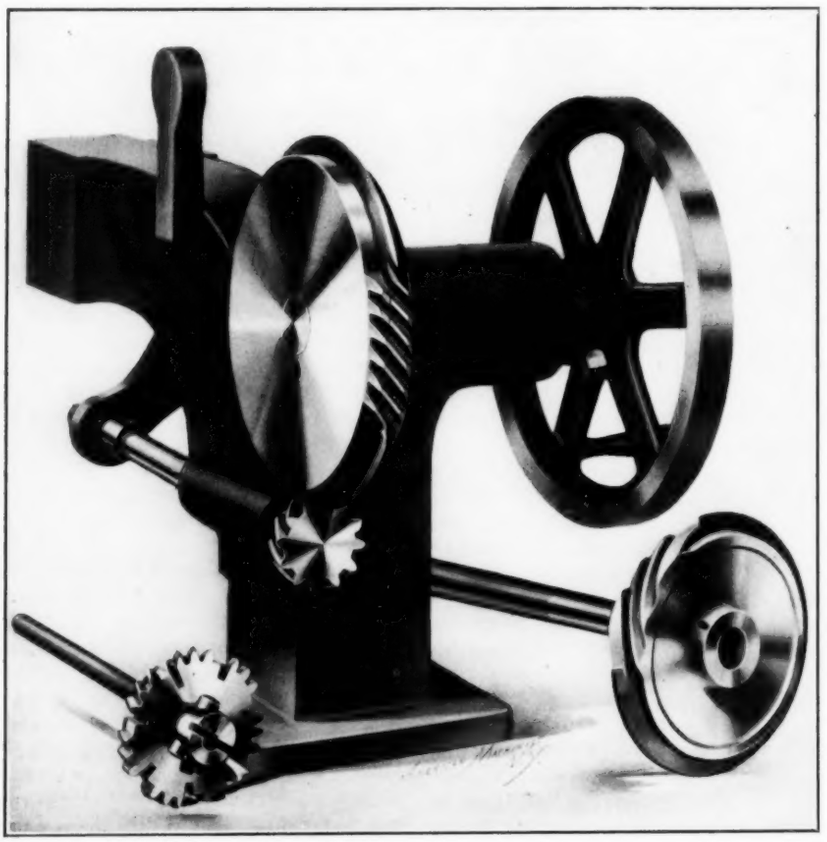
Next to the drafting machine the biggest improvement I have found in a long time is a curtain of tracing cloth on a spring roller at my work window. It gives a beautifully soft and even light all over the board, but I should hate to tell how many years I worked at that window before I thought of the simple thing.

E. R. PLAISTED.

Intermittent Spiral Gears.

Editor American Machinist:

Some time ago I was improving a certain machine. The main or driving shaft in this machine was required during one-sixth of one revolution, to rotate a second shaft, at right angles to it, through 180 degrees. This second shaft was at that point to be locked in position and remain so, while the driving shaft completed the remaining five-sixths of its revolution.



INTERMITTENT SPIRAL GEARS.

The original machine was equipped with a bewildering array of ball and socket joints, connecting rods, adjustable sleeves, ratchets, pawls and finally a nice little train of spur gears. I had had little experience with spiral gears, but possessed a vague idea that the motion I wanted could be obtained by using a pair of spiral intermittent gears. Owing to my limited knowledge on the subject, I decided to consult some of the firms who make a specialty of making gears. To my surprise, the first one declared he had never heard of such a thing, and ventured the opinion that it was impossible. I had better luck with the next one, who assured me that he had seen an illustration of such a gear, but where he could not remember. Having satisfied myself that it was possible, I wasted no more time making enquiries among men who ought to know all about these things, but secured two pieces of cast iron and "chopped" out the two gears seen in position on the machine. The result was all that could be desired, the pinion making one-half revolution during one-sixth of a revolution of the driving shaft. In the other pair of spiral intermittent gears the pinion makes one-seventh of a revolution to every turn of the gear. A good feature about this gear is the positive lock obtained by the central rib on the driver engaging with the rectangular slot on the driven wheel.

DIXIE.

Employment Department of the Westinghouse Electric & Manufacturing Company.

Editor American Machinist:

This company has in operation at its East Pittsburg works an employment department in charge of an expert mechanic whose duty it is to personally interview and pass upon each applicant as to his or her qualification for the position for which they apply, the company believing that the more thorough examination at this time the less liability of such person failing in the particular work for which they were hired. It is a well-known fact that where the hiring of factory help is left to the foremen the selection is apt to be influenced by personal reasons, often resulting in taking on trial persons physically or by reason of previous experience unsuitable for the work on which they are placed. The selection of relatives and general favoritism is a trouble common enough in some shops. I do not wish it understood from the above that the company does not allow the foremen any voice in the selection of help in their various departments, but the management asks that it take the form of a suggestion, the name suggested being written on the request for such help to this department, stating plainly for what purpose required, rate paid, and whether new help or a replacement. That persons thus suggested are subjected to the same conditions as other applicants tends to reduce the number of names suggested and causes the foremen to be extremely careful as to whom they suggest.

RECORD OF EMPLOYEES.

A very important part of the work of this department is the keeping of a card record of the employees. When a man is engaged, a card (employee's certificate) is made out and a check or pass number is allotted to him and his name, birthplace, birth year, month and day, with such other information as desired is noted thereon, to which he certifies by affixing his signature. This card is then compared with both the active and the inactive files, and should another card of the same man be found it will give a complete record of his former service with the company together with the reason for his leaving. Should this record be favorable, it is written upon the new card, which is then filed in the active case, while the old card is placed in a third file containing extras. The last card written up contains complete information found on all previous cards of the same person. When a man leaves the company, a quit form is filled out in duplicate stating the reason for his leaving, the copy being forwarded to the employment department immediately. The card of the person thus leaving is taken from the active file, written up from the quit slip, and filed in the inactive file, where it would be found should he ever apply for work with the company again. The same form of quit slip is used if an employee is absent from the factory two weeks and no word has been received from him, or for those absent on leave, sickness or injury who wish to draw all money due them. This is found to be necessary in order to keep the records up to date and a new employee's certificate must be filled out on the return of such a person.

NOTICE OF REDUCTION OF FORCE.

Should it be found necessary to reduce the force in any department, a list of the employees to be dispensed with is furnished the employment department in advance, if possible, and an effort is made to place them in other departments where vacancies exist, such transfers, new check num-

bers, etc., being noted upon the card record.

The foregoing system has been in operation about two years and has proven satisfactory. Aside from the greater care exercised in the selection and the distribution of help, we are enabled from our record of an ex-employee to determine whether his reason for leaving entitles his application for re-employment to consideration. An ex-employee is expected to return to the same section that he left should there be a vacancy. If no vacancy exists in his old section and his foreman so recommends, he is eligible for re-employment in any section. This ruling has to a large extent reduced the number of quits from help of the class who are continually wanting a change of work. The knowledge that it may be obtained only upon merit and the approval of their foreman results in increased efficiency and is of benefit to both the employer and the employee.

D. H. Creider.

Mr. Edison and the Patent Office.

Editor American Machinist:

Since the publication, at page 763, of my letter to you regarding the charges filed by Mr. Edison against two members of the Examining Corps of the Patent Office, the report of the Acting Commissioner of Patents has been filed with the Secretary of the Interior and has been approved by him.

The Commissioner's findings are exactly in line with the facts, as I stated them in my previous letter to you, namely, that there was absolutely no evidence of malfeasance or intentional wrong-doing on the part of the examiners, and that they had merely erred in judgment as to what constituted new matter in the divisional application of Jungner.

The examiners have not as yet been notified of the Commissioner's intention to transfer them to another division, and to do so would seem to be rather hard on them, since it is inevitable that all examiners will err sometimes in judgment. Moreover, since the mistake was one of practise, not involving anything of a technical nature relating to the art of electrochemistry, and since the same questions of practise arise in all the divisions of the Patent Office, there does not seem to be anything to be gained by their transfer, except to satisfy Mr. Edison.

Possibly many of your readers are not aware of the vast quantity and multiplicity of questions coming up constantly for decision by the examiners. These questions comprise questions of law, such as patentability, equivalency, etc., technical questions such as the operativeness of inventions, and questions of Office practise, such as joinder of inventions. Their duties are both executive and judicial, and instead of merely having to decide questions of law and of fact, presented to them as they are to judges in court, they have to procure to a large degree their own evidence —that is to say, they have to search the prior art, involving vast numbers of domestic and foreign patents and publications, as well as keep track of all applications pending before them, caveats, and cases up for appeal or in interference.

Is it any wonder, then, that mistakes occur from time to time? The fact of the matter is that the work of the Examining Corps, far more strenuous than that of any foreign Patent Office, is well done and that few errors of judgment and still fewer actual mistakes occur.

Howard A. Coombs.

Time-Keeping Overdone.

Editor American Machinist:

A machinist who is evidently reading the articles describing the various methods of cost keeping has become very much interested in the different methods mentioned for keeping track of the time of the men. He does not expect to keep costs, but he does have to put in time. Following out his own methods of investigation of the various ways described, he sometimes tries making out his own time in the way described, as that seems to him a practical test under his working conditions.

I will say in explanation that this man is a working foreman, and so is interrupted oftener than would be the case if this were not so, but he says that the day that he watched his time so closely was not one of his real busy days, and also that he did not take any account of interruptions that did not require him to stop the work in hand.

The system that he had under consideration was the one where the time of beginning and of ending a job is marked, and also the name of the job given. Thus, if a man began turning a pulley at 7 o'clock he would mark that in the first column, and if he stopped it at 10 o'clock he would put that in the second column, and so on for every job started. If any of the jobs was not finished without some other work being done, it would have more than one entry. By this method the exact time spent on each job could be known to a nicety, as the man did not have to make any mental additions but simply put down the time of starting when he started, and the time of stopping it when he stopped. All that was needed in the way of apparatus was a clock with a good, plain face set in a place where it could be seen from his place of work.

He knew that I was interested in such things, and after putting down his time carefully in this manner for a day he gave it to me. I also have his regulation time slip, which was put in as required by the company that employs him.

In the one way of putting in the time, there are 52 separate charges, there being 35 in the forenoon and 17 in the afternoon. There had been one general job, and he had worked 21 different times on it during the day. An inspection of the time sheet shows that he has also 2 charges for looking up finished stock, 3 charges for looking up castings, 6 for inspecting work, 4 for instructing men, 1 for inspecting old material turned in for repairs, 4 for adjusting and slightly repairing machines, 4 for repairing tools, 1 for work on new tool, 1 for a consultation with another foreman, 1 for taking dirt out of a man's eye, 3 for writing orders on the stockroom, and 1 for a trip to the basement. The time spent in keeping track of these various subdivisions of time is not given. While the time spent in looking at the clock, getting a pencil and marking the time down would be very short for each time, yet short as it might be it would still amount to something when multiplied by 52. The attracting of the attention to that point and keeping it before the mind would also subtract somewhat from the work. In his usual way of putting in time all the time put on the regular job, which constituted a part of the machinery built by the firm, was charged in a lump to that job, and the remainder of the time was charged to the shop.

While I realize that the time slip, as put in as a sample by this man, is not at all an average even for that shop, yet it does illustrate that there are places where the orders to charge time to the nearest quarter of an hour would not be any more accurate that to let the men lump all of their time on each separate class of job.

The other extreme of time keeping I found in a shop where the men did not have any time slips to fill in. The cost-keeper passed through the shop several times a day and saw what jobs the men were engaged with. Each job had a number given it when it was started, and this number was marked prominently on the job whenever it could be done. Certain kinds of shop work, such as repairs to machines, sweeping, etc., were given a number that was a permanent number for that class of work, and all time doing that class of work was reported under that fixed number. As these divisions were not many, it did not take a man long to get these numbers fixed in his mind.

The cost-keeper, who, by the way, was a very intelligent young lady, did the work of getting the time from the men herself. Each man had a number. Small slips of white paper were used to make the original entry for the men. First the man's number was put down, and then the number of the job and the time on it. If the man had worked on several jobs since the time of the last visit, a separate slip was used for each one. With men on large jobs not subject to much change the same slip might be used and the time from one period to the next simply noted on it. One route was always taken when the time was being taken, and as the young lady came walking along a slight nod told her that the man had not worked on any other job since her last visit, and she would not stop, but simply mark a slip as she passed

along. She said that it did not take much more time to collect the time than it did to just walk over the route without stopping, and without doing anything, and she further said that it did not take her as much time to do it in this way as it formerly did when she had to keep going out to look up incorrectly charged time. She did the writing of the orders to the men, under direction of the superintendent, and so knew of all the work that was under way in the shop.

These slips were sorted in two ways. First the day's slips were sorted so as to bring each man's slips together, and his time was entered on the time book from them. Then they were sorted by the job number and filed in that way until the job was completed. As this lady had other duties besides those of cost clerk it seemed to me that an assistant would not be out of place for her, but on intimating as much I was told that she had tried several and had found that it was more work keeping things straight with them than it was to do it all alone. As an illustration, she said that in taking up the time a man would often give her the wrong number, but that she would at once detect it, for she carried the number of each job in her head, but that the assistants would put down anything that the men said without question, and apparently without thought, and without concern.

I would say that this shop was building machine tools of a fairly large size, and so the job numbers were not very numerous, and they ran in some cases for weeks before the job was finished. Inquiry showed me that it would be in the neighborhood of six months from the time that a set of orders was written for one of the large-sized lathes, not the largest, before they were all finished and in.

That system seemed to work well in that place, as I have no doubt that the first system described will in some places, but I do not think that either of them would be found suitable for the average shop.

WILBER.

Improved Lathe Headstock.

The half-tones herewith completely tell the story of a new lathe headstock with interesting and important improvements which have been brought into existence under the stimulus and demands of the modern high-speed steels. The improvements here to be noted have to do entirely with the main spindle and its drive. There is nothing to interfere with the employment of the lathe for any class of work upon which it has heretofore been employed, but it still is better equipped for the more strenuous demands of the day. By the arrangement here shown a remarkably strong drive is secured while the main spindle is entirely relieved from all belt strain.

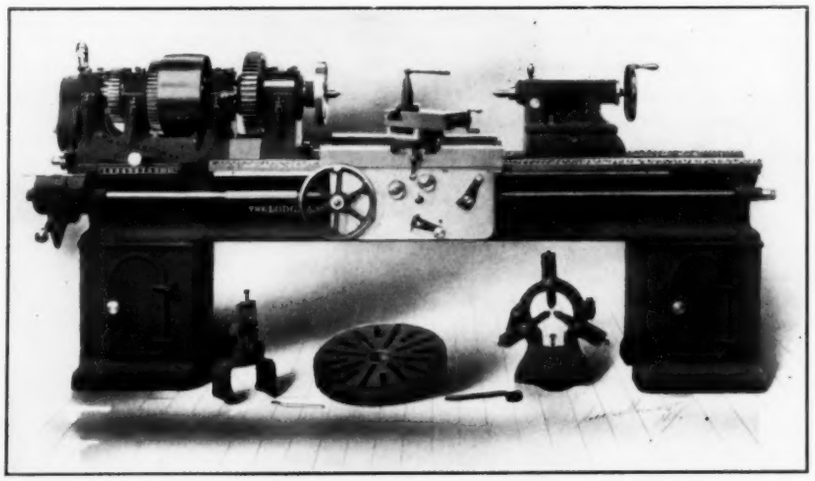


FIG. 1. 20-INCH LATHE WITH IMPROVED HEADSTOCK.

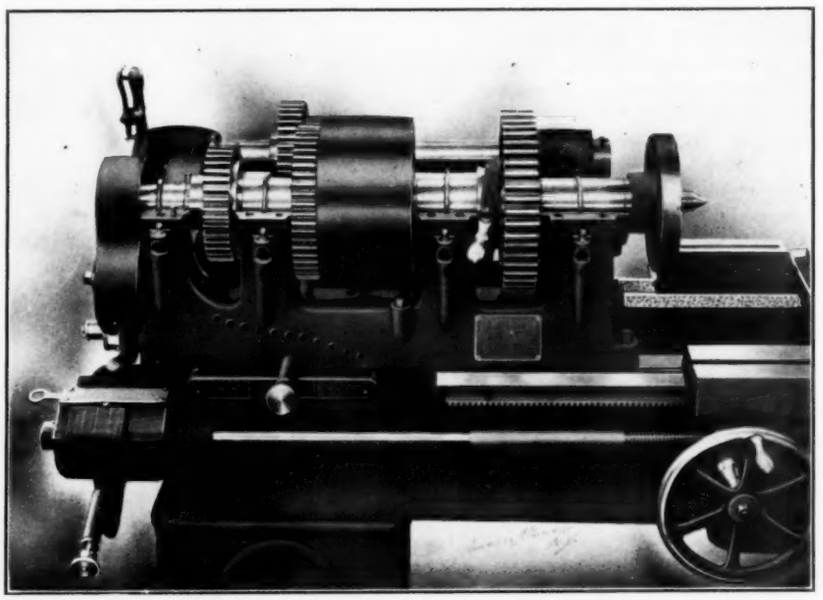


FIG. 2. HEADSTOCK WITH CAPS REMOVED.

Fig. 1 shows the lathe complete with the improved headstock. The great width of the driving pulley will be noted as compared with the usual width of the several steps of the familiar cone pulley. The four distinct bearings provided in the headstock also will be noticed, and Fig. 2 shows the caps removed from them. Only the two outer bearings carry the main spindle, which is thus given unusual length and steadiness. The two inner bearings are for the sleeve which carries the driving pulley. While the main spindle passes through this sleeve, it does not touch it, so that the belt pull on the sleeve is absolutely unfelt by the spindle. Fig. 3 shows the spindle removed. The clutch face on the front end of the pulley sleeve will be noticed. This engages with a clutch which slides on the inside of the main gear on the spindle, and when this is employed the spindle of course turns at the same speed as the pulley. At the other side of the pulley and keyed to the sleeve are two gears of different sizes, one in front and one behind the rear bearing of the sleeve. There are two sliding gears upon the back-gear shaft which, when not in use, are located between these gears on the pulley sleeve and either of these is brought into mesh by sliding in one direction or the other according to the speed required. There are thus the direct drive of the pulley and the two gear speeds, or three different speeds in the lathe itself, and this with three different speeds in the countershaft gives nine speeds in all. The back-gear ratios are 3 to 1 and 9 to 1.

The back-gear and shaft, shown removed in Fig. 4, are made in one piece, excepting of course the sliding gears. The shaft runs in self-oiling bearings at the ends instead of the familiar arrangement of a sleeve running upon an eccentric shaft. As seen in Fig. 4, the bearings are eccentric in this case and are rotated together by the rod which connects them. The back-gear shaft is hollow and passes easily over this rod.

An important feature of this headstock is in the self-oiling bearings which are

provided throughout. Deep oil wells are cast in the bearings for the main spindle and sleeve, each holding at least a pint of oil. On the front of each bearing is a lug bored for the insertion of a glass tube which constantly shows the hight of the oil. Mounted on the spindle and sleeve in the middle of each journal are brass

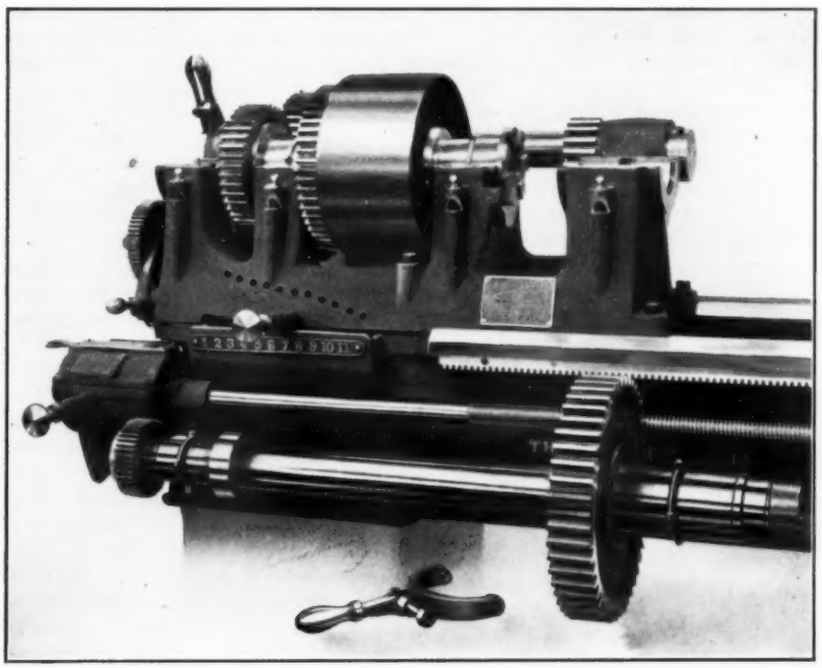


FIG. 3. HEADSTOCK WITH SPINDLE REMOVED.

rings with projections which dip the oil and constantly drop it on the journals. The construction is such that it is impossible for any oil to get out of the bearings and they will not require attention more frequently than once in three months. If the backing belt is not required on the countershaft, and a large and increasing number of lathes are run without it, it may be made to give three additional forward speeds for the lathe, or eighteen in all. The lathe, in other details sufficiently familiar to our readers, is built by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio.

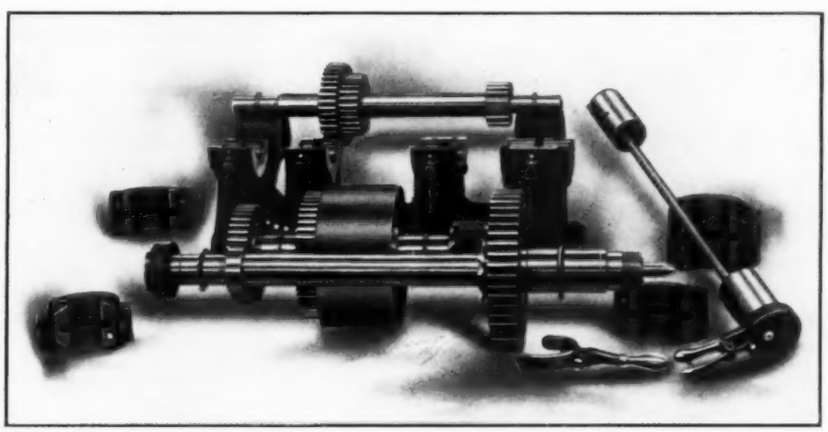


FIG. 4. 20-INCH HEADSTOCK IN DETAIL.

The St. Louis Exposition.—VI.

EDITORIAL CORRESPONDENCE.

The middle of June finds the exposition in a state representing great progress. In the rear part of the grounds some of the exhibits, such as the Philippine village, the South African War exhibit and others of that character are still unfinished and about the main buildings the steam roller may still be seen at work. The incompleteness is not, however, sufficient to mar the general effect, which is grand and imposing beyond description. Of course the Chicago exposition educated the American people to large things in these matters and disparaging comparisons can be heard, but such comparisons are largely due to the fact that lapse of time as well as distance lends enchantment to the view. The American people can hardly again experience the surprise and astonishment that accompanied their first view of the Chicago fair, and that surprise was, no doubt, a large factor in their judgment of that fair as it is in their comparisons with this one.

Within the buildings it is safe to say that 90 per cent. of the exhibits are complete and that figure might be stretched by some to 95 per cent. Except at the western end of the Palace of Machinery, there is nowhere within the buildings an air of disorder, and even there the disorder is not such as to seriously interfere with effective examination of most of the exhibits.

The buildings in which the readers of the AMERICAN MACHINIST are most interested are naturally the Palace of Machinery, the Palace of Electricity and the Transportation Building. Of these the exhibits of the last two are substantially complete and the Transportation Building especially will, with our readers, divide attention with the Palace of Machinery. Two of the exhibits in the Transportation Building are in the highest degree noteworthy and will long be looked back upon as memorable. These are the exhibits of the Pennsylvania and Baltimore & Ohio railroads, respectively. The former is in daily operation and systematic tests of locomotives have begun, altho one serious difficulty has presented itself in the fluctuating water pressure used in the Alden brakes for absorbing the work of the locomotive under test. From an engineering standpoint this test plant is far and away the most interesting thing about the exposition, and the crowds constantly about it attest that it is an equal popular attraction. People dearly like to "see the wheels go round" whether they know what they are going around for or not. However, the spectacle of a locomotive in full work but at rest is certainly a novel one, and it is not to be wondered at that it should attract notice, especially as the noise of the exhaust serves to direct those who are looking for it and to attract the attention of those who are not.

The Baltimore & Ohio exhibit is of the same character as the one made by the same company at Chicago and indeed contains many of the same items, but the collection has been much enlarged. Moreover, while the Chicago historical exhibit was composed chiefly of full-sized models, the one at St. Louis contains many real locomotives which have become historic and many gaps which existed in the Chicago exhibit have now been filled, making, doubtless, the most complete exhibition of the kind which has ever been made. Through its aid the entire history of the locomotive may be traced, the engines in which nearly every essential feature of present day practise first appeared being represented. Going over the list carefully, I was unable to find more than a single gap—namely, the engine in which the link motion made its appearance—but I am not sure that so much as the name of that engine now remains.

The exhibit is not confined to locomotives but contains some car and track

history as well. The first locomotive to draw a load on rails was built by Trevithick and was set at work in South Wales in 1804, drawing "waggons" loaded with iron. A model of the locomotive is here, while behind it are the actual "waggons" and below it are the actual rails, all of which have been sent from Wales. The rails are of channel section—flange up—while the wheels have no flanges and the rails are supported upon blocks of stone with nothing to preserve the gage of the track but the embedding of the stones in the ballast. Here also is the oldest passenger car in America, and probably in the world, which was placed in service in Nova Scotia in 1838.

Great care has been used to make the models of the old engines fairly represent the originals. In many cases the models have been made from the original drawings or from tracings therefrom, and in all cases the best attainable data have been followed. For the collection we have to thank the enthusiasm and research of Major J. P. Pangborn of the Baltimore & Ohio. I hope of course to give the readers of the AMERICAN MACHINIST a more complete account of the exhibit in a later article, but at this time when people are asking what there is at the fair worth seeing this brief account may be of interest. The old locomotives and models (the latter full size and very realistic reproductions) number over fifty and the mechanic who can walk down those long aisles without feeling that he really ought to take off his hat deserves to be shut out of machine shops for the remainder of this world as well as in the world to come.

As always happens when the government takes a hand at making an exhibition, the government building is one of the most interesting, and of the entire collection in the building there is nothing more noteworthy than the new photographic pictures called by their inventor, Mr. F. E. Ives, stereograms. They are upon glass and at first sight are not noteworthy. Before them and at a distance of perhaps 14 inches is a vertical wire and the observer is told to place his face against this wire with the wire between his eyes. When he does this the picture disappears and in its place stands the object which the picture represents in solid relief. The effect is absolutely that of looking at the solid object with no picture effect whatever. So perfect is the illusion that in some cases the object appears to stand in front of the glass between it and the observer.

Mr. Ives is well known in photographic circles as the inventor of the half-tone engraving process, of the orthochromatic photographic process, of a successful system of photography in colors and of the closely allied three-color system of printing. In his latest achievement, having no one else to outdo, he has outdone himself. At the Chicago fair he was honored by having his system of photography in colors exhibited in the Government Building and the honor is repeated here.

The usual crop of illuminating remarks by general visitors to technical exhibits is beginning to develop. Looking at one of the machines of the Norton Grinding Company when in operation, the other day, a fair creature asked the operator if he would not please save some of those stars for her, as she would like to take them home as souvenirs.

The criticisms on the lack of provision for personal comfort which were made during the early days of the fair no longer hold. An ample number of stations for the supply of drinking water have been supplied at which, for a cent, one can get a glass of excellent artesian well water, and toilet facilities are ample. Restaurant charges within the fair grounds are very reasonable and the service very complete when compared with either the Chicago or the Buffalo fairs. Restaurants may be found within a short walk of any point on the fair grounds and, circumstances considered, no one can complain at their prices. Many of them serve a course luncheon of soup, meat, vegetables, desert and coffee for 50 cents, while if one wants a lighter luncheon sandwiches are large in size and reasonable in price. While the larger hotels of the city have undoubtedly raised their prices, there is no lack of accommodations of a more modest character at reasonable rates.

By the time this reaches the reader's eye what remains of disorder will, no doubt, have largely disappeared, and I believe that the sooner the visit to the fair is made the more satisfactory it will be. Later in the season the crowds are sure to be large, which will mean much in the way of discomfort. F. A. H.

The word day has no real meaning without an adjective defining what kind of a day is meant, for there is a civil day, the astronomical day, the apparent solar day, the mean solar day and the sidereal day, making five different ways of measuring a day. The civil day commences at the midnight preceding mean noon, and consists of twenty-four hours counted after 12 o'clock; the astronomical day begins twelve hours after the civil day, or at the mean noon of the corresponding civil day. These hours are reckoned from 0 to 24. It will be seen, therefore, that while 10 hours 12 minutes, January 1, astronomical time, is also 10 hours 12 minutes, January 1 civil time, yet 22 hours 12 minutes, January 1, astronomical time, is also 10 hours 12 minutes A. M., January 2, civil time. There are many anomalies growing out of this use of the civil day, and there are many arguments in favor of using the astronomical day. It is one of the reforms which undoubtedly will come some time.—*Mining Reporter.*

Some Labor-Saving Suggestions for the Foundry.

The following is from a paper by H. F. Frohman read at the Indianapolis meeting, June, 1904, of the American Foundrymen's Association:

I readily appreciate the fact that many foundrymen will say, "We have all the modern facilities, and why should we not produce our castings at the minimum cost?" Yet there are many *small* labor-saving devices that can be introduced, which, used in connection with the more important equipment, and with good management, should make the foundry business a successful one.

While foundry supply-men are considered a nuisance by some, to others, I am happy to say, they are heartily welcome. The foundry supply-man is brought in contact with the foreman and molders, and an exchange of ideas has resulted in many a simple and successful device being put on the market, to the benefit of all concerned.

While I was visiting a certain foundry I noticed a molder using a perforated piece of tin to hold up the core in the mold. The idea seemed to be excellent, and the explanation of the molder that the tin being perforated allowed the iron to unite with it more thoroughly than would otherwise be the case, seemed conclusive. The suggestion was taken up, and now perforated tin chaplets are on the market in all sizes that are required. Foundries making very thin castings have found them exceedingly serviceable; in fact, they would not do without them if they could help it.

Another simple thing is a core coating. This is used on a steel core, where a number of these may be used in one casting. The method is to dip the steel core into the coating, set it into the mold, and the iron will flow freely around it, making a perfect hole with neither a chill nor a blow.

A mold-drying apparatus. This is a device for doing away with burning charcoal in a dry sand mold. It is used with a direct flame from a torch, in connection with compressed air, the result being more economical and satisfactory than the old style.

My attention was called also to the chiseling out of follow-boards and match parts, and after much study and experiment, with the assistance of the shop and the laboratory, a compound was gotten up which can be poured into a temporary mold, using the original pattern, and a satisfactory match made at one-tenth the cost of the old method. After setting, this match becomes almost as hard and as true as the iron itself, and makes an excellent follow-board or sand match, which becomes better as it gets older, and retains a perfect parting.

In many foundries where dry sand molds are made, it seemed a hard problem to put a liquid blacking on the molds

evenly and well distributed. It seems that when this blacking is prepared for use, and allowed to stand a few minutes, the blacking settles at the bottom. This trouble is now obviated by using a compressed air blacking swab. This swab mixes and distributes the blacking very evenly over the surface of the mold, and can reach any part inaccessible to the hand. For this reason the result is much more perfect, and the castings are brighter, cleaner and better in every way.

I might mention also the various designs of sand-sifters used in a foundry. By adopting these machines many a dollar has been saved. There are now machines on the market which can riddle as much sand in one hour as formerly required the labor of two men for a whole day. It is also said that these machines temper the sand much more thoroughly. Facing sand may be prepared by them, and their use in the core-room is also highly advantageous for mixing sand with the various compounds, flour or rosin.

I remember, years ago, there was a certain foundry in Ohio, where they employed girls to make the cores. Should a stray salesman happen to wander in to see the foreman, these girls would spy him, and take all the conceit out of him that he ever possessed. I happened to be in that foundry again a few years later, dreading to approach that core-room, but to my agreeable surprise found the young ladies wanting, and instead two boys operating two machines for making cores which formerly were made by not less than twenty-five persons. The machines were constantly fed, and as fast as the wheel could turn made satisfactory cores, true and round and well vented—in fact faster than the molders could use them.

In this same shop powdered rosin was constantly used, and formerly two men were required to grind it by hand. Later on a machine was devised, which operated at a very low cost, for powdering and pulverizing rosin. It now runs for two hours, in charge of a boy, and produces more powdered rosin than is used for a day.

A word regarding the use of good facings and blacking may not be amiss. I have noticed that where formerly foundrymen used graphite by the pound, it is now used by the ton, showing conclusively that it is more economical to use high-grade plumbago to face a mold, at a few cents cost, than to spend dollars in the cleaning room in cleaning and chipping castings. Furthermore, it is to the interest of the foundryman to purchase a grade of facings and blacking suitable to his respective class of work, and the very best is always the cheapest. As advancement has been made in the foundry, so it has in the manufacture of facings and blackings. The materials are turned out with the most modern machinery, and the raw materials kept under chemical control. The foundry facing man now knows that he is furnishing the proper material for the particular purpose.

A Curious Picture

We have received from L. D. Burlingame, chief draftsman with the Brown & Sharpe Manufacturing Company, a photograph, which we reproduce herewith, and with it a letter as follows:

"Enclosed you will find a photograph which has an interesting history. Several of our Brown & Sharpe men had visited an exhibit of paintings and etchings by J. McNeil Whistler and had exchanged views regarding their merits. A few days later one of these men, in handling some sheet stock, noticed a piece that suggested to him the style of the 'Whistler' pictures. It had a dark brown rust spot across the center, and someone had evidently started to rub this off with a piece of emery cloth. The effect of the silver gray of the steel representing sky and water, with the brown of the rust spot appearing like a bold promontory, made it very effective. When it was shown to me it at once excited my interest. We put in the lighthouse to accentuate the effect, and framed it. It has proved so interesting to those that have seen it that we had it photographed, and I send you a copy, thinking it may be of interest to your readers as a sample of the 'art of the machine shop.'"

A CURIOUS PICTURE.

Rust Spots on Calender Rolls.

Calender rolls are a constant source of worry to the paper-maker, in particular the rust spots that make their appearance on new rolls. How is it that rust spots do not form on rolls which have been some time in use? Simply because while in use they have become covered with a thin layer of adherent oxide which is permanent and preserves the iron from further action. A writer in the *Wochenblatt* gives a recipe for artificially coating the rolls with this thin permanent rust film. In the mills the new bright metal surface is often smeared with tallow. This must be removed and the rolls put in a moist place, so supported that the metal surface is wholly free. After a few days the thin rust layer which has formed is rubbed well in all over the surface with a moist cloth. This operation is repeated three or four times and completed by rubbing over with petroleum to remove dirt and dust particles. The rolls are now ready, and can be used straight away without causing further trouble. The operations may be hastened by using weak vinegar (one part of vinegar and three of water), and wiping with a cloth dipped in the liquid. The rust layer then forms in a few hours and the operation can be repeated three or four times. In the course of a day a sufficiently thick layer of oxide has accumulated.—*Paper Trade Journal.*

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Preposterous Fire Precautions.

The recent burning of an excursion steamer in New York harbor with its attendant horrors is an event which startles all humanity and it is impossible to refrain from comment upon it. Of what is done it is not necessary to say anything except for the lessons enforced as to precautions for safety in the future. Attention is sharply called to the conditions under which excursion boats, ferryboats and other craft are constantly operated with not the probability but the almost absolute certainty of the occurrence of "accidents" such as that which now horrifies the world. The details of unsafety which are habitually tolerated by the unthinking public, and by the inspectors and assumed protectors of the public, are too many to be all even hinted at here. The things which might have been different and which would either have prevented the accident or have greatly diminished its fatalities are evident enough after the event. Perhaps the most striking feature of the case is the absence of all provision for prompt and immediate action at the instant when fire begins. The "Slocum" was not at the time overcrowded, was not even fully loaded, according to its precedents of loading. The writer has personally been on board of her when there were probably double as many crowding her decks as on the day when she took fire. On all the excursion steamers with which we are familiar there is a conspicuous absence of watchmen or men of any kind in any way looking after the safety of the vessel. We have made many trips on these boats, moving freely about, and have rarely seen a single man or officer representing the boat management, except occasionally one who raised or lowered a flag or a lantern and those who would make an appearance from somewhere when a gang plank or a hawser was to be handled. Then, again, it is possible that many of the boats carry fire extinguishers, but if so they are not conspicuous. In the case of the "Slocum" we hear nothing of them. At this writing it appears that the fatal fire began in a closed cabin or compartment forward, and it seems quite probable also that if there had been watchmen about, and especially if they had been provided with readily accessible fire extinguishers, there would have been such a sudden and effective squelching of it that the public would not have known anything about it. The utter absence of all adequate precautions against the one danger of fire on these boats, not to speak of the other dangers which may accompany it or which may bring their own horrors without the fire, is sufficiently evidenced by the shock which the reader of these lines is likely to feel when we suggest that automatic sprinklers should be provided upon these boats. Yet, why not? Where it is only property alone that is to be protected the sprinklers do good service and are widely installed. Why should it be preposterous to propose automatic and instantly operative sprinklers where human lives by the thousand are to be saved? These things cost something, which is the sufficient explanation, and we should all be satisfied with it even if it costs us our lives. There are other precautions against incipient fires on excursion boats which will suggest themselves and which need not be mentioned. There should be telephonic or other electric communication between all the points where men are on duty or where they should be on duty, so that they could be at once apprised of danger and could be massed at the most effective points; but that is another preposterous thing to suggest; nevertheless, these preposterous things are things most necessary to be insisted upon and we have only hinted at one item of the list.

The Manufacturers' Mutual Fire Insurance Company has so studied fireproof and slow-burning construction as to make serious fires in buildings insured by it practically impossible and nearly unknown. There is a strong monetary interest in preventing fires and in reducing rates of insurance to next to nothing. There can be no doubt whatever that the same principles applied to steamboat fire prevention would make such a fire as occurred on the "General Slocum" nearly, if not quite, impossible. It is only a matter of the intelligent expenditure of a little money and it will be a disgrace to our civilization if any such horror ever occurs again.

Discriminations Against American Manufacturers.

It is apparent that many American manufacturers are growing restless under certain conditions which they claim are unfair to them. For instance, the fact that American steel for shipbuilding is sold abroad at prices about 40 per cent. lower than the rates at which identically the same steel can be had by an American shipbuilder is arousing the wrath of many who are interested in American shipbuilding, and there are those who insist upon it that with American steel at the same price as the foreigner gets it American shipyards would be fully employed instead of being almost entirely idle, as they now are.

So serious has this matter become that the *Iron Age*, which has always been the stout defender of whatever has been done by the steel trust, is asking if it would not be politic for it to incline its ear to the cry of the American shipbuilder before his cry becomes too strenuous and is taken up by other industries.

We can certify that a good many machinery builders are asking why they should be compelled to pay more for American steel than their foreign competitors pay for the same steel all for the benefit of the steel trust, while at the same time New England manufacturers are asking why they should pay $1.50 to $2.00 more per ton for coal for the benefit of the anthracite coal trust than they would have

to pay if they could get coal from Nova Scotia direct by boat.

There are good and patriotic American citizens who believe that tariff schedules are sacrosanct and inviolable and that nothing whatever should ever be said against them; but then there are others who insist that they should be considered from the business point of view, and who do not believe that asking the steel trust and the coal trust to be moderate and to refrain from taking full advantage of the schedules is sufficient or likely to be at all effective.

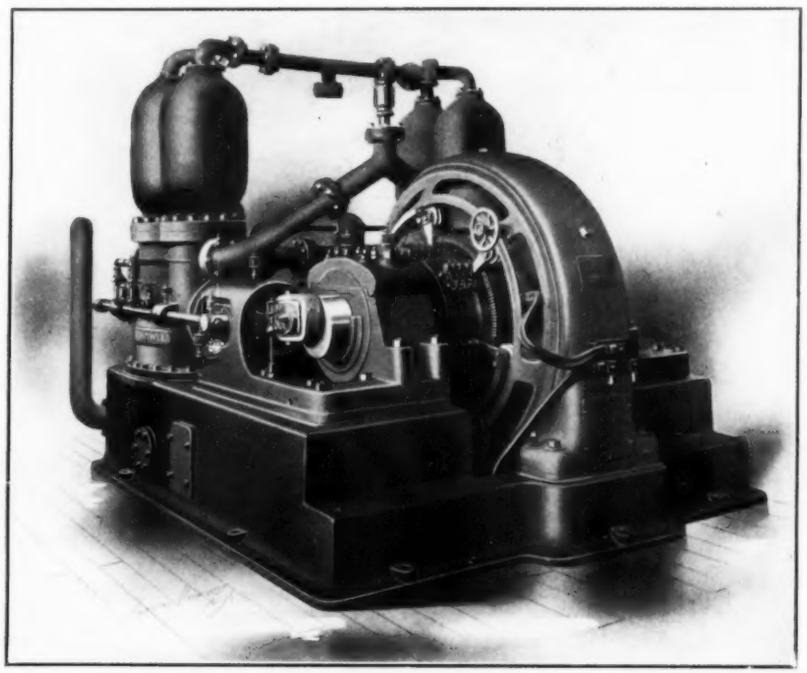
American twist drill manufacturers who have a large foreign trade are finding themselves handicapped, especially in the matter of supplying drills made of high-speed steel. This steel is so expensive that the cost of material is important in the drill trade and English drill makers get the same steel at prices so much lower than our American manufacturers can get it that the latter are at a great disadvantage. Several representatives of English tool agencies have been here recently conferring with drill manufacturers as to what can be done to meet the situation, and tho there is a rebate of duty on foreign steel used in the construction of exported goods it is doubted if this can be of much help because the material must be identified—a difficult thing to do—and there is no allowance for wastage, which in the case of twist drills is heavy.

It is cause of complaint also by millers near the Canadian border that the rebate of duty on Canadian wheat is of no use to them because they are required to identify a given barrel of flour going to Canada as having been made of Canadian wheat—an obvious impossibility.

Some New Things

A DIRECT-CONNECTED MOTOR-DRIVEN PUMP.

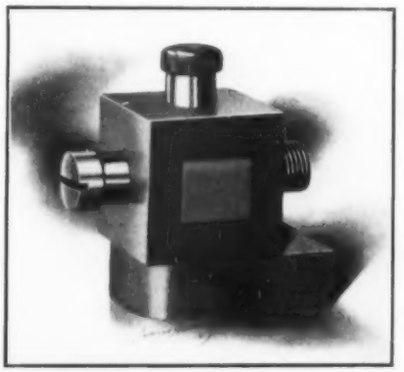
The half-tone shows a double pump driven directly, without gears or belt, from the shaft of an electric motor. It is especially adapted for mining or other continuous and exacting service. The pump crossheads are connected directly to cranks at each end of the motor shaft. The cranks are set at right angles and each pump is double acting, or has two plungers connected by outside rods and with outside packed stuffing boxes, so that this responsible portion of the pump is always accessible. The plungers are 3½ inches diameter and 5½ inches stroke. The pump and motor are mounted upon a rigid box girder frame and the unit is self-contained and occupies a relatively small space. The motor is a General Electric 100 horse-power six-pole 200-volt shunt motor. The pump has been thoroughly tested at speeds from 280 to over 300 turns per minute with reported efficiencies up to 90 per cent. for the motor, 93 per cent. for the pumps and a combined efficiency of 84 per cent. These pumps are built in different sizes with capacities from 200 to 4,000 gallons per minute, and for heads from 100 to 2,000 feet, by the Blake & Knowles Steam Pump Works, 114 Liberty street, New York city.



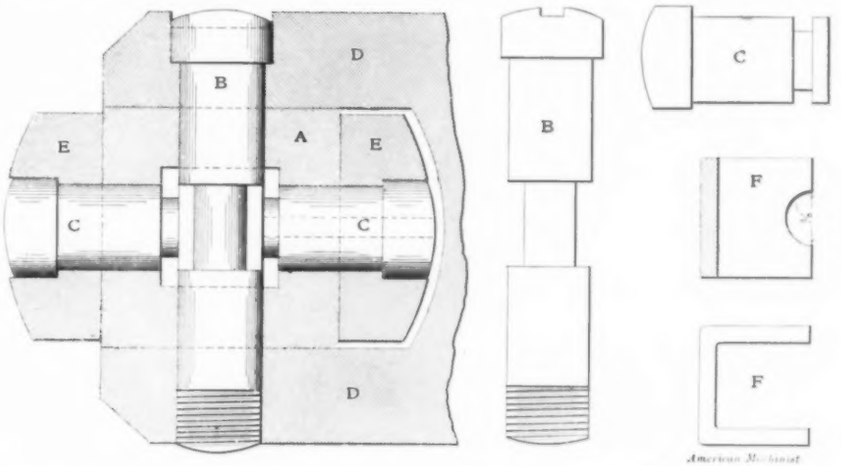
A DIRECT-CONNECTED MOTOR-DRIVEN PUMP.

VANDERBEEK'S UNIVERSAL COUPLING.

The universal joint or coupling here shown is one of several that have been made by the Vanderbeek Tool Works, Hartford, Conn., the present being designated the automobile universal coupling. The half-tone, Fig. 1, shows the central block with all pertaining to it and one side of one of the jaws attached. The sectional view in Fig. 2, with the separate details shown, will make it easily understood. The hardened steel cube *A* has round cross holes, all in the same central plane, on four sides of it, the connecting pins being free to turn in these holes, and from one to the other of the two remaining sides is a large square hole. The pin *B* has its head sunk into one side of the fork *D* and the other end screwed into the other side, thus securing the pin in the fork. The pins *C* are driven or pressed into the sides of the fork *E*, the knurling



VANDERBEEK'S UNIVERSAL COUPLING.

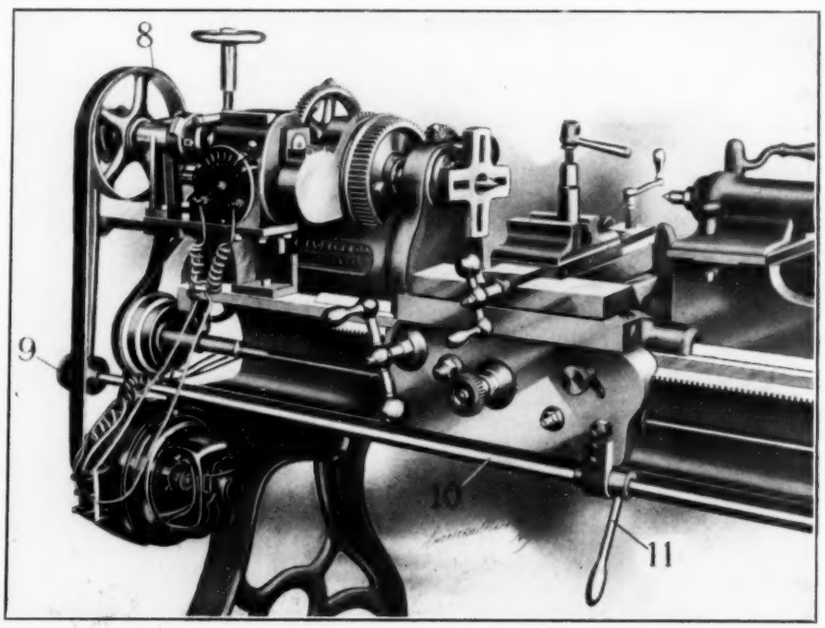


SECTION AND DETAILS OF VANDERBEEK'S UNIVERSAL COUPLING.

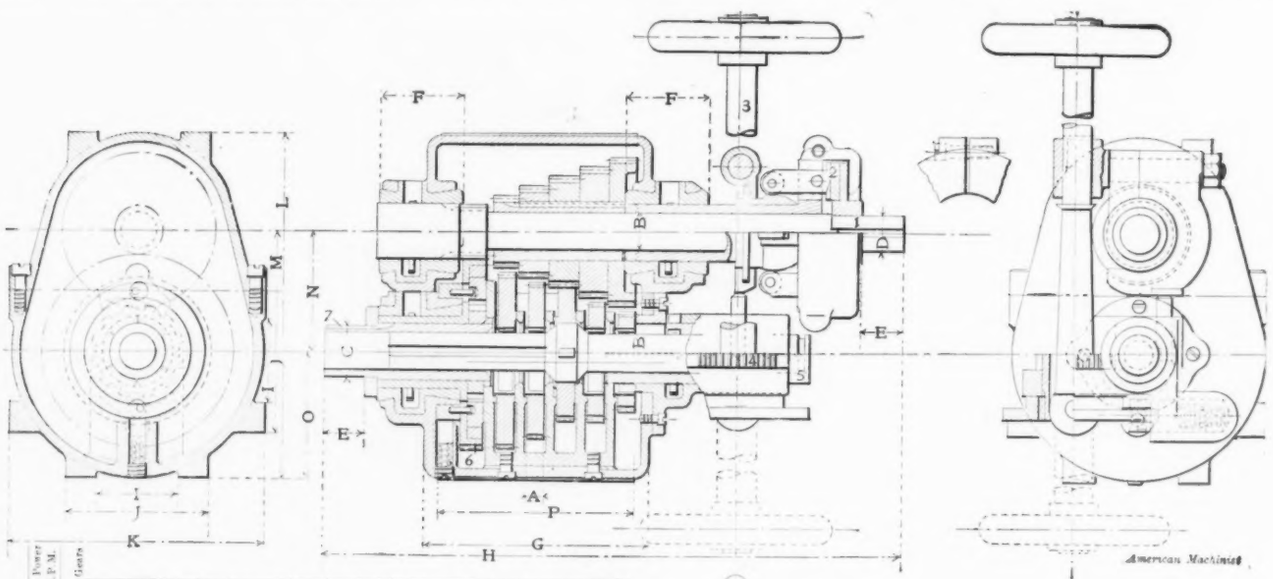
on their heads helping to secure them from turning in the fork. The pins thus are all held so that they will not turn in the forks but will turn freely in their bearings in the block *A*. It will be noticed that the pins *C* are grooved near their inner ends, and when they are in position the wings of the pieces *F* drop over the pins and into these grooves and hold them from moving endwise. These pieces *F* also serve to close the ends of the large square hole in the block and to retain within or between them oil-saturated felt, which will maintain the lubrication. One of the pins *C* is provided with an oil hole through which the entire joint may be supplied. It will be seen that this construction will allow the two connected shafts to work at a considerable angle from the straight line.

A NEW SPEED CHANGER.

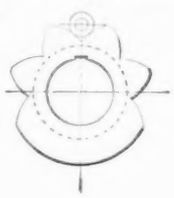
The accompanying illustrations show a 14-inch Putnam lathe arranged to be driven by an electric motor and employing a mechanical speed changing device which its makers, the National Machine Tool Company, of Cincinnati, call their improved speed changer. The device was hastily applied to this lathe principally for making tests and the exact method of applying and the wiring of motor, etc., is of course crude, but seems to show the value of a drive of this character over the former belt drive. The speed changer is made in six sizes ranging from ½ horse-power to 10 horse-power. Fig. 1 shows the device in section and the principal dimensions for the six sizes are shown in appended table. The gearing is of mild steel, case-hardened, and is contained in the oil-tight casing, which is bushed for the driving and driven shafts with ring oiled phosphor bronze bearings. The casing is parted half way between the driving and driven shafts and is doweled and held together by screws. Planing pads are shown on four sides for convenience in applying it. The upper cone of gears excepting the small pinion which is turned on shaft 1, is controlled by the friction 2. The lever 3 is ball seated into gear 4 and is connected by a yoke to the cone for engaging and disengaging the friction 2. The hand-wheel shown attached to lever 3 is used for making the change of speed, being connected to the gear 4 which engages the racked half sleeve 5. The driven shaft is turned down, leaving an enlargement at about the center which is beveled at both edges and is provided with spring keys to clutch into the seats cut into the bores of the gears. The longitudinal motion of sleeve 5 slides the driven shaft and the beveled edges of the enlargement upon it imparts vertical motion to the lower gears, meshing and unmeshing them from their mates above as it passes through their bores. The largest gear 6 of the lower cone is always in mesh with the pinion turned on driving shaft and carries pawls



A NEW SPEED CHANGER.



Horse Power 325 R.P.M.	Pitch Gears	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
½	14	⅜	13/16	1 1/16	11/16	⅝	1⅜	4 11/16	12	1⅜	3	5⅜	7¼	1¾	2¼	2 11/16	4 1/16
1	12	9/16	1	1 7/16	15/16	1	2⅜	6¾	16	2	3½	6¾	8½	1 11/24	2 11/12	3 5/16	5
2	10	⅝	1 3/16	1 11/16	1⅛	1¼	3	8⅝	21⅜	2¼	4	8	10⅝	1⅞	3⅛	4	7⅛
4	7	¾	1 7/16	2 1/16	1⅜	1½	3⅝	10¾	25⅜	2½	4½	11	11⅞	2⅝	5	5⅛	9⅛
7	6	1	1 11/16	2⅜	1⅝	1¾	4¼	12	29½	2¾	5	13½	17⅛	2 11/12	5 5/12	6¾	11
10	5	1⅛	1 15/16	2¾	1 13/16	2	5	13¾	35	2⅝	5½	16	21	3⅜	7	8	12⅝



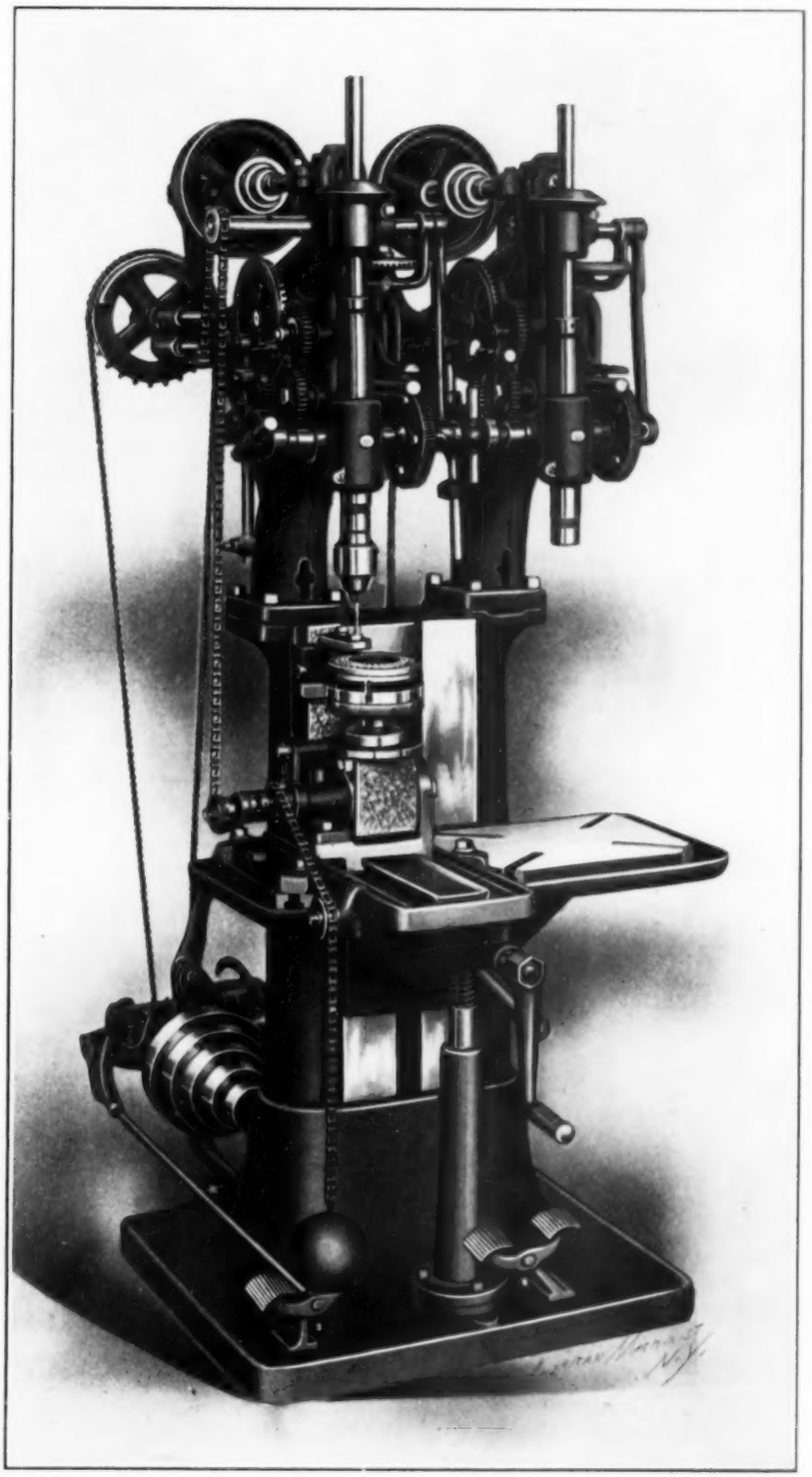
A NEW SPEED CHANGER.

which engage a ratchet fitted to sleeve 7 which is splined to lower or driven shaft. The ratchet, which is really a part of the driven shaft, will always revolve faster than the pawls when any speed other than the slowest is used, but when the friction 2 is released the driven shaft will slow down until it reaches a speed equal to that of the pawls, which will then do the driving. The pawls are automatically reversible, which makes them effective when running in either direction. A locking device prevents a change of speed until the slowest speed is in action and the friction 2 cannot be engaged until the enlargement on driven shaft is in the proper position to engage the selected gear. Fig. 2 shows the speed changer mounted on a bracket bolted to shear of lathe bed. The motor, which is bolted to leg of lathe, is belted to the friction pulley 8. It is a Western Electric Company's make. The friction pulley 8 is operated by cam 9, secured to the splined shaft 10. A handle 11, carried by the apron and engaging the spline of above mentioned shaft, controls the starting and stopping. With the old arrangement of belt drive there were four changes of speed without back gears, as follows: 100, 170, 290, 390.

With the lathe driven as shown we have six changes of speed without back gears and an electrical variation between the increments of mechanical change by the use of the small rheostat shown attached to the gear casing. The spindle speeds obtained mechanically are as follows: 70, 104, 146, 210, 297 and 420. These speeds are in geometrical progression (as nearly as gears will allow) with a ratio between steps of about 1.44.

AN AUTOMATIC INDEXING CHUCK FOR AN AUTOMATIC DRILL.

The half-tone shows a two-spindle automatic drill built by B. F. Barnes Company, Rockford, Ill., with which, in its original form, our readers are already familiar. This drill has now been made more completely automatic by the addition of an automatic chuck for holding work in which holes are to be drilled in circles with regular or predetermined spacing. A piece is shown mounted in the chuck, and two or three circular rows of holes have been drilled in it. The base which carries the chuck may be slid in or out, and the chuck may be used either vertically, as here shown, or inclined at any angle down to the horizontal position. It is not here necessary to describe the continuously automatic mechanism of the drill itself. The chain which operates the automatic chuck is attached to the large gear which operates the spindle, and as this gear turns, backing up the spindle, the weight on the other end of the chain takes up the slack, and when the crank pin on the gear goes down it pulls the chain over the sprocket wheel on the horizontal shaft of the chuck, and by means of a lug on this sprocket the plunger disengages from the notch in the notched or spaced plate, which is interchangeable according to the spacing required, and as soon as it is disengaged the friction at the front end of the horizontal shaft, by means of miter gears, turns the notched plate to the next notch, when, by a spring mechanism, the plunger again engages, thus spacing the work for the next hole very quickly and before the spindle returns. The adjustable guide for the drill is of course attached to the machine frame and is placed as close to the work as practicable. The interchangeable notched plate is what determines the spacing of the drilling. The notches may be equidistant or at unequal distances, so that the spacing is always less than half the circle. The chuck which holds the work may of course be of any size or style best adapted to it. This automatic chuck arrangement can be attached to any

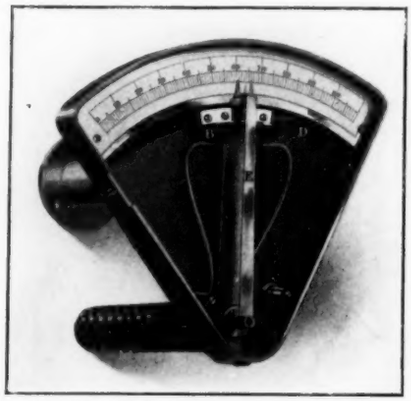


AN AUTOMATIC CHUCK ON AN AUTOMATIC DRILL.

of the 14-inch or 20-inch "Manufacturers" drills made by the above company.

BRISTOL'S THERMOMETER-THERMOSTAT.

The name given to this instrument aptly describes its function. It is a thermometer giving correct indications of the temperature of air, gas or liquid and at the same



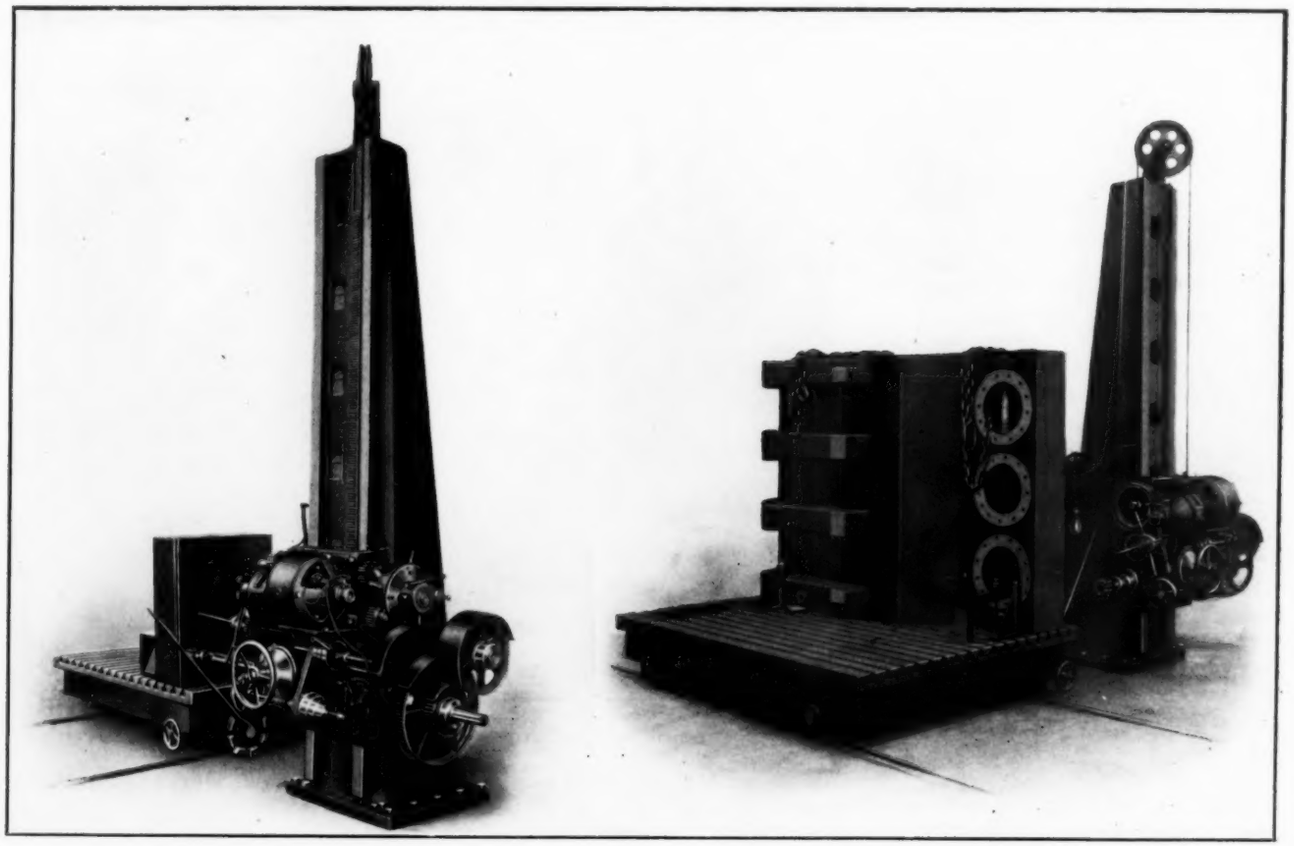
BRISTOL'S THERMOMETER-THERMOSTAT.

time serving as a thermostat to make electric connections at any predetermined point for the purpose of operating controlling apparatus, alarms, etc. The halftone sufficiently shows the construction and operation. The arm *E* indicates the temperature. This arm is operated by one of Bristol's well-known recording thermometer tubes placed in the perforated projection at the back of the instrument. At the back of the arm *E* there is a projecting portion which makes electric connection between the contact pieces *B* and *C* on the inside lever *A*. This lever is movable for adjustment to any temperature required and is retained where placed by friction. The wires connecting to the contact pieces are also connected to binding posts, as shown, for making the outside connections. These posts are placed inside the case so that they cannot be tampered with. Three holes with insulating eyelets are provided in the lower part of the case for the insertion of connecting wires. The high and low contacts can be placed on single or on independent circuits. The temperature arm *E* is not restrained in its movement by the contacts. For temperatures above the atmosphere a small bulb is located within the closed space or pipe and this bulb is connected with the thermometer-thermostat by a capillary tube filled with alcohol, and the instrument may be located at any convenient point for observation. A cover which is locked on leaves the scale and pointer exposed to view. The instrument is made by The Bristol Company, Waterbury, Conn.

HORIZONTAL DRILLING AND BORING MACHINE.

This machine consists of a vertical housing upon which is a carriage carrying a complete horizontal drilling and boring machine. The housing is securely bolted to I-beams spaced a few inches apart, and laid on a suitable foundation, the spaces between the I-beams are filled with concrete and a layer of cement finishes off the top. The rails upon which the work carrying truck runs are also bolted to the I-beams. Horizontal adjustment of work at right angles to the spindle is obtained by moving the truck along the rails. The vertical adjustment is taken care of by the carriage mounted on the housing; this carriage is counterbalanced and can be readily elevated or lowered and clamped in position. The spindle has automatic feed of 24 inches. The spindle speeds range from 7 to 220 revolutions per minute with eight changes. There are four changes of feed for each spindle speed varying from .007 to .067 inch per revolution. The feed mechanism, which is patented, is operated through suitable gearing and can be quickly changed by shifting a lever. The feed can be quickly returned or advanced to any position, and the clutch locked or unlocked, without the operator taking his hand off the hand-wheel. The thrust on the spindle due to feeding is taken by a ball bearing. The driving mechanism consists of a standard shunt-wound motor and a simple arrangement of change gearing mounted direct on the spindle carriage. Current for the motor can be taken by sliding contacts from two wires stretched along the column, or through a flexible cable, as desired.

The motor runs continuously during operations, and the spindle is started, stopped



HORIZONTAL BORING AND DRILLING MACHINE.

or reversed by the clutch lever which is conveniently located for the operator. The work-table mounted on the truck is 6 feet wide, 8 feet long and 17½ inches high; it is provided with a lever arrangement for moving it to exact position and a brake for locking it. These machines can also be supplied with a base upon which the vertical housing is gibbed, so that it can be slid to and fro by means of a screw. The builders are Pawling & Harnischfeger, Milwaukee, Wis.

A Visitor From the Argentine Republic.

Mr. F. Boenicke, who is a manufacturer of agricultural implements in San Nicolas, B. A., Argentine Republic, and a reader of the AMERICAN MACHINIST of long standing, is now in this country and has been looking about considerably among the agricultural implement manufacturing concerns, tool building shops, etc. For some time Mr. Boenicke has been a purchaser of American machine tools and has also in former times purchased from England. He gives a very interesting account of industrial conditions in his country and speaks very encouragingly of the recent arrangement between his country and Chili regarding the agreement to cease their wars, which he said were formerly very great hindrances to the development of both countries. He described the former condition as being one in which the men were constantly called away to perform military duty of some sort and believes that the recent agreement has been reached because the Argentine Republic has developed so much faster than Chili that Chili has seen the hopelessness of continuing the wars.

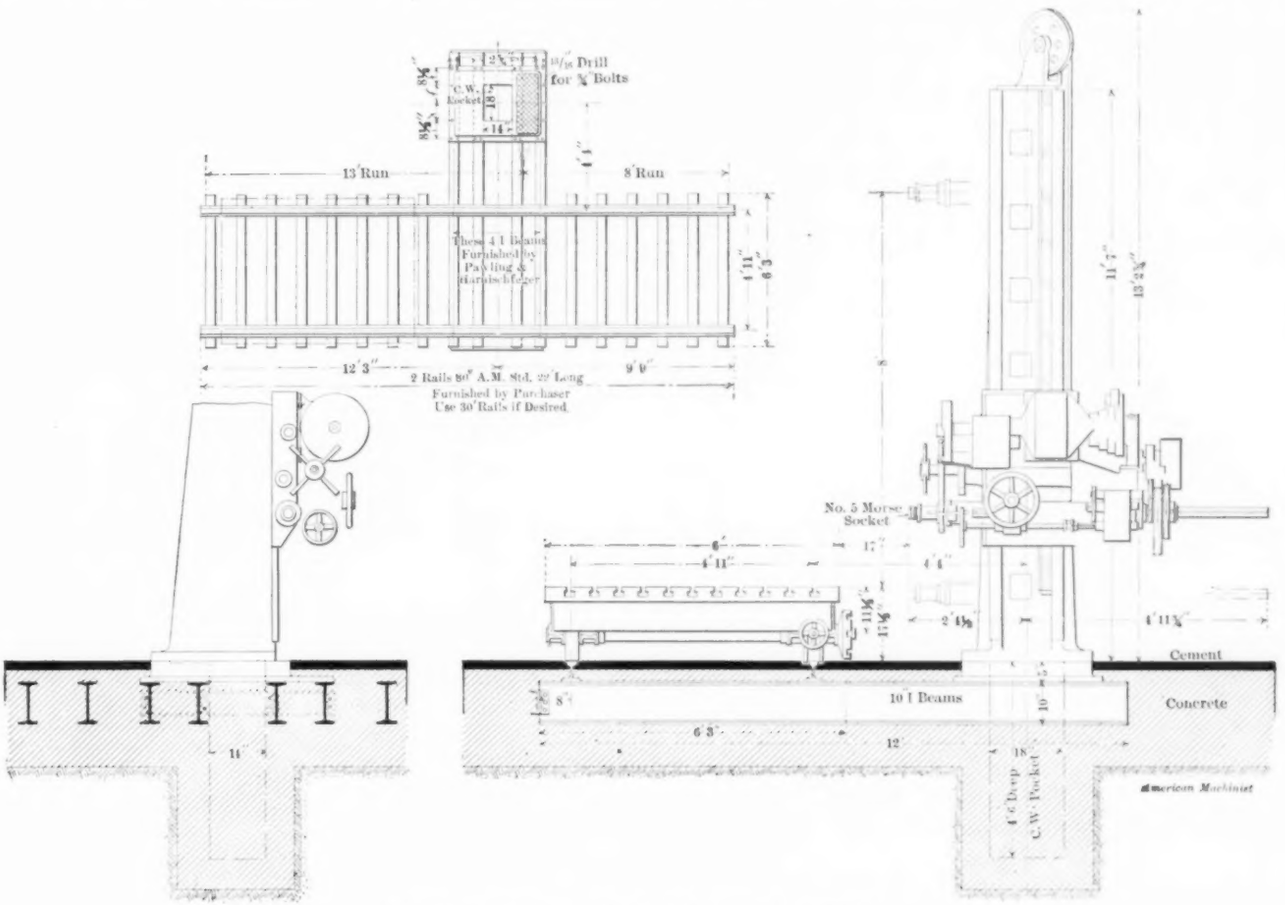
While Mr. Boenicke has a very high opinion of Argentina and its capabilities, especially in agricultural lines and its possibilities of development, he declares that the government is very bad, mainly on account of the entire absence of anything resembling civil service reform. The tenure of office of an administration is six years, and after every election there is a complete change in all government offices. Even the president and employees of the National Bank, no matter how successful they may have been nor how necessary it may be that they should be continued in office in order to continue the business of the bank, all are discharged and new ones put in their places. This naturally interferes with business very greatly and is much regretted among business men, who, however, find it impossible to help themselves in this matter, as they are also in regard to the bribery which generally prevails and under which payment of some sort must be made for the benefit of officials whenever official action of any kind is to be secured.

The numerous holidays in the country interfere very much with industrial operations, a great many saint days having to be observed and the workmen insisting upon observing every one of them, tho their object in this seems to be rather to have a good time than to really worship the various saints.

Owing to the character of the help to be obtained in Argentina Mr. Boenicke states that machines that are very heavy are preferable, and this applies not only to agricultural machinery but to machine tools as well. English threshing machines, for instance, are preferred by those who are able to pay for them because they stand the rough usage better. On the other hand, the American machines have the advantage in the matter of transportation from one point to another, because they are lighter and can be gotten over the bad roads of the country more successfully.

A peculiar feature of the situation is the fact that while pig iron, bar iron, structural materials and agricultural machinery are imported into Argentina free, there is a duty on machine tools amounting to 30 per cent., notwithstanding the fact that no machine tools are made in Argentina nor is there apparently any prospect of them being made there.

Pullman cars precisely like those that run on our roads furnish accommodation for 70 cents that costs $2.00 here.


13' Run
8' Run
These 4 I Beams Furnished by Pawling & Harnischfeger
2 Rails 80# A.M. Std. 22' Long Furnished by Purchaser Use 30' Rails if Desired
No. 5 Morse Socket
Cement
10 I Beams
Concrete
C.W. Pocket
American Machinist

A NEW HORIZONTAL BORING AND DRILLING MACHINE.

Personal.

Robert McF. Doble, of San Francisco, consulting and supervising engineer, making a specialty of hydro-electric power developments and long-distance power transmission, has become identified with the Abner Doble Company, engineer, and manufacturer of tangential water wheels with needle regulating nozzles.

Business Items.

The S. Obermayer Company, Cincinnati, O., has recently shipped to the Scott Oliver Car Company, Knoxville, Tenn., an entire foundry equipment, consisting of six carloads, including cupolas, blowers, ladles, tumbling mills, foundry facings and supplies of all kinds. The Scott Oliver foundry and machine shops will probably be the largest and best equipped plant south of the Ohio River.

The Canadian Rand Drill Company, Sherbrooke, Quebec., has just closed an order with the Canadian Westinghouse Company, of Hamilton, Ont., for the installation of a Rand-Corliss compound, power driven air compressor, to be installed in its new plant. This machine is designed to furnish air for the various pneumatic appliances throughout the works and is to be driven by a Westinghouse motor through a Morse chain drive. The International Coal & Coke Company, Coleman, Alberta, has just placed an order with the Canadian Rand Drill Company for a 300 horse-power, steam driven Rand duplex compressor of the latest type.

Among the sales made by Crocker-Wheeler Company during the past week is that of electrical machinery to the value of about $30,000 to the Barbour Flax Spinning Company, Paterson, N. J. The equipment includes a 600-kilowatt standard direct-current 250-volt generator, and motors, with ratings from 5 to 100 horse-power, aggregating 515 horse-power; also for its plant in Baltimore, the W. & J. Knox Net & Twine Company, it has bought a 100-kilowatt generator and 75 horse-power in motors. The United States Naval Academy, Annapolis, has just purchased two 250-kilowatt Crocker-Wheeler generators for a two-unit, three-wire lighting system; and the J. B. Williams Company, of Glastonbury, Conn., a 150-kilowatt engine-type generator. Armour & Co., Chicago, who already use Crocker-Wheeler motors to the amount of about 70,000 horse-power have placed an order for three more machines, aggregating 110 horse-power. Twenty-eight motors of the same make, with a combined power of 253 horse-power, have just been purchased by the Traitel Marble Company, Ravenswood, L. I.

Manufacturers.

The Pearce woolen mills, Greenville, Pa., have been burned.

The Moline (Ill.) Produce Company is to install cold storage.

One of the Manchester (Ia.) Woolen Mills has been burned. It will be rebuilt.

The Virginia Woolen Company's plant at Winchester, Va., has been damaged by fire.

A plant of the Ninety-Six (S. C.) Cotton Mill is soon to be equipped with machinery.

The Southern Handle Company, Huntsville, Ala., is starting to build in South Memphis, Tenn.

Carrollton, Ga., has voted to issue $45,000 bonds for water-works, sewerage and electric lights.

A building in Chicago occupied by the Patent Vulcanite Roofing Company has been damaged by fire.

The F. W. Gunther Company, Racine, Wis., will erect a canning factory and will make its own cans.

R. L. Humber, Greenville, N. C., is about starting to erect a machine shop on the site of his old one.

It is hoped to have the plant of the Iowa Malleable Iron Works, Fairfield, Ia., in operation by August 1.

There are proposed extensive improvements to January & Wood Company's Maysville (Tenn.) cotton mills.

The jewelry and novelty factory of M. W. Carr & Co. in West Somerville, Mass., has been damaged by fire.

McCloskey Bros., proprietors of the Catasauqua (Pa.) Boiler Works, are preparing to move into a new plant.

A. Knabb & Co., Warren, Pa., manufacturers of barrels, staves, etc., propose to build a plant at Marcus Hook, Pa.

It is believed that Armour & Co., Chicago, will add another cold storage building to the plant in the Sioux City district.

The Bausch & Lomb Optical Company, Rochester, N. Y., has applied for a permit for a 42x424-foot factory, 50 feet high.

The plant of the Kinne Manufacturing Company, sheet metal articles, Minneapolis, Minn., has been badly damaged by fire.

A four-story factory building will be erected in Frankford, Philadelphia, for Jacob W. Walton's Sons, manufacturers of combs.

Boese, Peppard & Co., embroideries, 458 Broome street, New York city, propose to build a plant at South Norwalk, Conn.

The Worden Brothers' Monument Manufacturing Company will erect works in Batavia, N. Y., and open a quarry near Barre, Vt.

The contract has been let to build a new factory for the F. A. Neider Company, Augusta, Ky., manufacturer of buggy specialties.

A permit has been issued in Allegheny, Pa., to the Pittsburg Stove & Range Company for a two-story ironclad building on Preble avenue.

The Virginia-Carolina Chemical Company, of Richmond, Va., and elsewhere, is about to erect a $250,000 fertilizer plant in Jackson, Miss.

The people of Marion (Ind.) have decided to start a $100,000 new factory fund, and have formed a Citizens' Improvement Association.

A 1,000-barrel flour mill may be erected at Tacoma, Wash., by the Sperry Flour Company, San Francisco, Cal., in merger with another concern.

Col. M. W. Harding, vice-president of a new National Bank of Humboldt, Neb., has launched a project for the establishment of a brick yard there.

The Philadelphia & Reading Railway Company will, it is reported, soon begin the construction of a great coal storage plant near Abrams Station, Pa.

A factory is understood to be under construction at Galesburg, Ill., for the Wenzelmann Manufacturing Company, hardware specialties, now of Streator.

The Dallas (Tex.) Electric Cotton Mills, of which C. C. Waller is one of the prime movers, has an idea to build a big mill at Paris, Tex., as well as at Mabank.

The Dunkirk (N. Y.) Chamber of Commerce has a proposition from a large textile company, operating knitting and other plants, to move one of them to that place.

The Kaolin Company, Boulder, Colo., has placed on the market a new polishing and cleaning substance, called Kaoloid, produced from material found in that region.

The contract has been awarded for a 200x45-foot, five-story factory building and an office building for the Winchester Repeating Arms Company, New Haven, Conn.

The Commercial Association, Ottumwa, Ia., has received a proposition from the manufacturers of an improved wagon and hay scales, who may move to Ottumwa.

Arrangements have been made, as a result of which the Standard Stove Works, of Birmingham and Fort Payne, Ala., are expected to build a plant at Columbus, Miss.

A manufacturing plant is to be erected in Camden, N. J., for Eavenson & Levering, wool scourers, Philadelphia. A good sized boiler- and engine-house will be included.

The Gleason Works, of Rochester, N. Y., have purchased 20 acres of ground on University avenue, Rochester, near the campus, on which there will be erected fine new shops.

J. L. Donahoo, of the American Handle Company, Jonesboro, Ark., and Adolph Trimler, of Indiana, have purchased a site on which they will build a factory for some purpose.

The Kerosene Oil Engine Company will erect a building on First avenue, College Point, L. I., N. Y. The company is said to have a plant in Manhattan Borough which it intends to remove there.

The city council of Grand Island, Neb., will, up to and including July 6, receive sealed bids on the installation (also on mere delivery) of a 2,000,000-gallons-per-24-hours steam pump. Ed. Hooper is city clerk.

Duplex Stamping Company may locate in Vermilion, O., and manufacture screen door hinges, latches, cupboard catches and a large line of specialties there. George Smith, presumably of that place, is cognizant of the matter.

A factory is proposed at Lafayette, Ind., to manufacture a stove invented by G. E. Kendell and W. L. Cowdin, the latter, or both, being Delphi, Ind., men. The Commercial Club of Lafayette has a shoe factory project in tow.

The contract has been let to build a factory, 42x60 feet, in Streator, Ill., for the G. & D. Manufacturing Company, composed of Frank Gahm and Herbert D. Dorman. It is intended to manufacture a patent elevator and other devices.

The Birmingham (Ala.) Machine & Foundry Company is shipping material to the Colonial Sugars Company, which is establishing a large plant in Cuba. The American Tool & Machine Company, of Boston, is supplying the centrifugals.

Louis I. Waldman, president of the Hudson River Aniline Color Works, Rensselaer, N. Y., and also the head of the color works on Van Rensselaer Island, Albany, is quoted as stating that his company is about to establish a large manufactory in the south end of Albany.

Joseph Benn & Sons, Inc., of Bradford, England, are to establish a textile mill at Greystone, a few miles from Providence, R. I. A 400-kilowatt Westinghouse-Parsons steam turbine will drive the machinery, and electric light will be driven from water power.

Ira R. Hayes, of Columbia, S. C., and W. L. Harper, of Winston-Salem, N. C., have incorporated the Damask Manufacturing Company, of Roaring River, N. C., for manufacturing textile goods. The capital stock is $125,000. It is understood that a cotton mill will be built at Roaring River.

G. E. Winton, who has been awarded the Bridgeport, Conn., city garbage contract for a period of ten years, has commissioned E. R. Edson, Cleveland, O., to draw plans for a reducing plant to be built on Asylum street. A 150 horse-power engine and 300 horse-power boiler will probably be installed.